AUTOMOTIVE INDUSTRIES

A CHILTON PUBLICATION

FEBRUARY 15, 1960

Features • • •

NEW ENGINES AT THE BOAT SHOW

MAKING ROLLS-ROYCE ALUMINUM ENGINES

NEW MACHINES AT SAGINAW STEERING DIVISION OF GM

RUST-PROOFING CARS AT CHRYSLER PLANT

Inside Rolls-Royce ▶

Engine Assembly Line Uses Trolley-Mounted Fixtures Rolled by Hand Along a Short Length of Track

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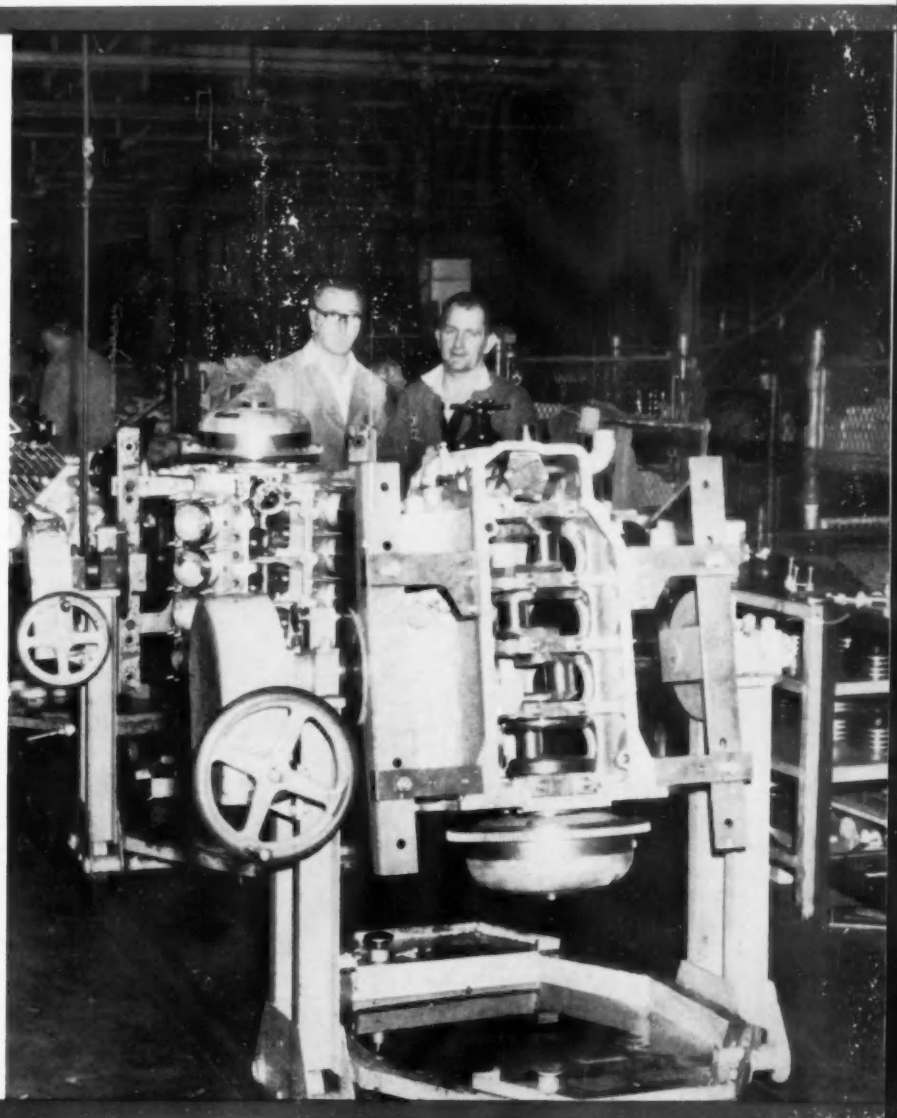
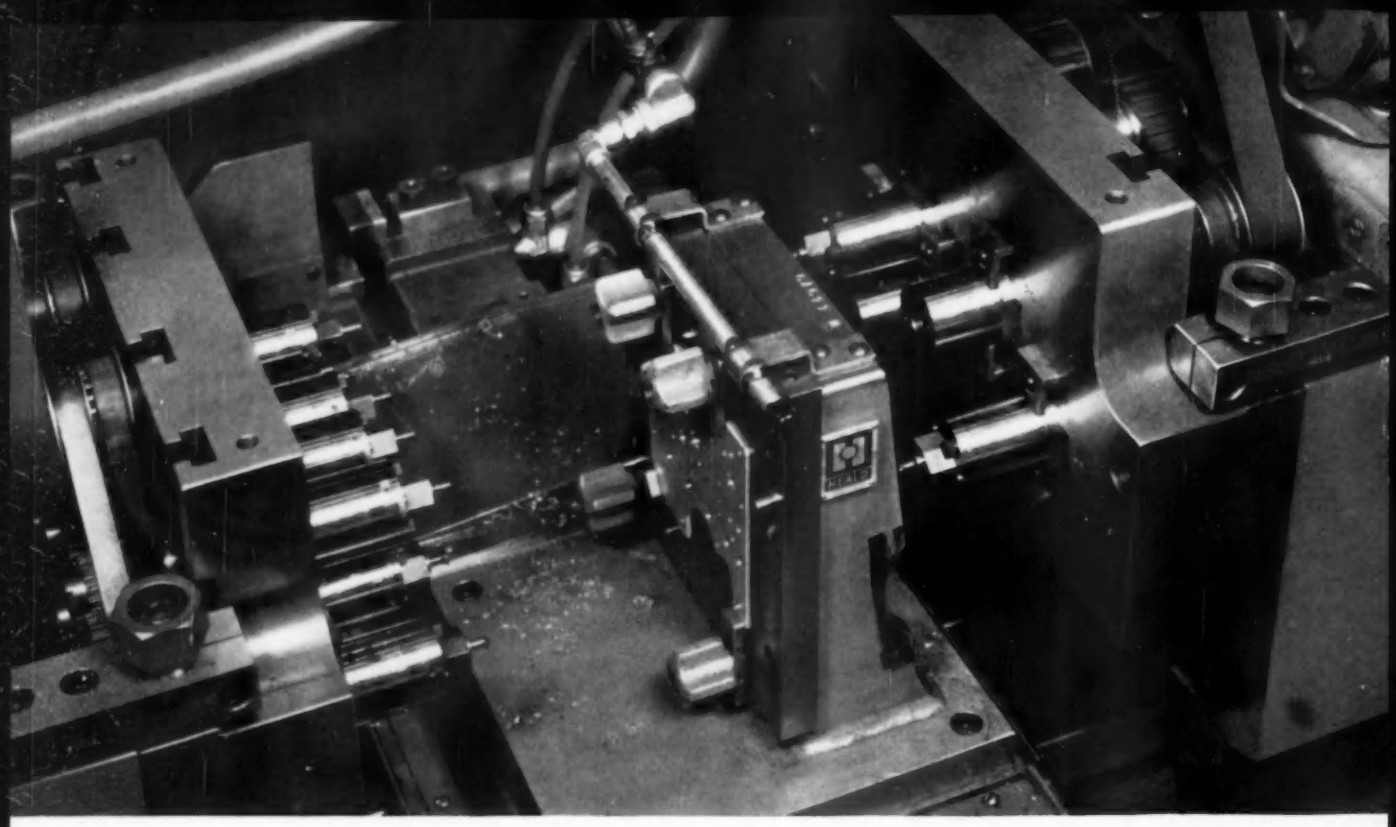


ENGINEERING
MANAGEMENT • • PRODUCTION
DESIGN



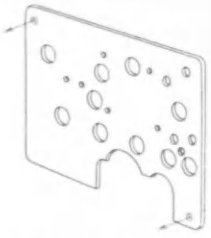
Bore 23 holes on 1 machine

Heald Model O Bore-Matic solves multiple-hole Borizing problem with interchangeable Multi-Spindle Heads

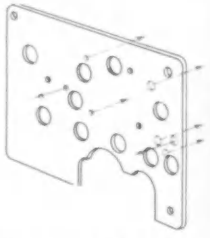
The Problem—to precision bore 23 holes, ranging from .0365″ to .3570″ in diameter, in medium-hard aluminum gear-box plates, with a tolerance of .0005″ on diameter and .0009″ on centers—also to bore 12 similar holes in a matching plate.

The Solution—a Heald double-end Model O Bore-Matic equipped with two sets of interchangeable Multi-Spindle boringheads. As shown in the drawings at the right, the 23-hole plate is precision Borized to the required tolerances in only three operations, using an indexing cross-slide and with all holes accurately positioned by cross-slide index and spindle location. One set of Multi-Spindle heads is used for the first two operations—then spindle plates are changed for the final operation. The second set of spindle plates also finishes all bores in the 12-hole plate in two operations. Average production is 10 parts per hour.

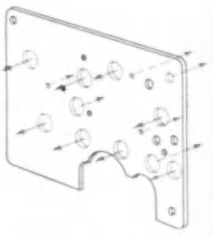
Heald Multi-Spindle boringheads consist of interchangeable spindle plates, precision bored to mount the desired number of miniature Red-Head boringheads which are belt-driven from a single motor. This arrangement permits simultaneous Borizing of multiple holes with center distances as close as ¾″. To save production time and cost on your multiple-hole borizing jobs, ask your Heald engineer for complete information on Model O Bore-Matics.



1. Bore two locating holes in single-end cycle using spindle plate No. 1.



2. Bore 7 holes in double-end cycle using spindle plates No. 1 and 2.



3. Replace spindle plates No. 1 and 2 with No. 3 and 4 and bore 14 holes in double-end cycle.

(Arrows show direction of table travel for holes indicated)

HEALD

MMT=pE

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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Circle 101 on Inquiry Card for more data

KNOW YOUR ALLOY STEELS . . .

This is one of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Quenching Media for Alloy Steels

In the quenching of alloy steels, several points require consideration, among them being the size and shape of the piece, the type of steel involved, the quenching medium, and proper agitation of the quenching bath.

The composition of the steel has an important bearing on the selection of a quenching medium. As an example: shallow-hardening steels require a fast cooling rate, whereas deeper-hardening steels require progressively slower rates as the alloy content increases.

Three commonly used types of quenching media for alloy steels are water, oil, and air. These are discussed below in the order of quenching severity:

(1) WATER. Since shallow-hardening steels require fast quenching rates, water is the quenching medium used to harden them. Agitation is generally used to help in obtaining the desired cooling rate. The use of brine solutions have proven beneficial when sufficient agitation cannot be obtained. It should be noted that the quenching rate drops as water temperature is increased. The range of 70 deg to 100 deg F is recommended.

(2) OIL. An oil quench cools more slowly than water, and faster than air. Oil-hardening steels can be hardened with less distortion and greater safety than water-hardening steels. Mineral oils are generally used because of their low cost and relatively stable nature.

(3) AIR. If sufficient alloying elements are present, critical cooling rates are decreased to the extent that certain steels can be quenched in either still or forced air.

While the choice of quenching medium is of prime importance, there is another factor that should not be overlooked. This is the agitation of the quenching bath. The more rapidly the bath is agitated, the more rapidly heat is removed from the steel, and the more effective the quench.

Bethlehem metallurgists will gladly help you with any problem related to quenching or other phases of heat-treatment. They are men of long practical experience in this field, and they understand fully the advantages and limitations of each method. Always feel free to call for their services; their time is yours, without obligation.

Remember Bethlehem, too, when you are next in the market for AISI standard alloy steels, special-analysis steels, or carbon grades. We are always in a position to meet your needs promptly.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

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... The complete range of sizes and types of finish plus close tolerances provide freedom of design ... *helps you make a better product*

... Quality controlled from start to finish helps provide a wide range of end use possibilities ... *helps you make a better product*

... Controlled mechanical properties provide flexibility of design ... *helps you make a better product*

These are just some of the reasons why it pays to specify B&W Job-Matched Tubing.

Call your local B&W District Sales Specialist, or write for Bulletin TB-361 for full information. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

B&W

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A CHILTON MAGAZINE • PUBLISHED SEMI-MONTHLY

FEBRUARY 15, 1960

Passenger Cars • Trucks • Buses • Aircraft • Tractors • Engines • Bodies • Trailers • Road Machinery • Farm Machinery • Parts and Components • Accessories • Production and Processing Equipment • Design • Production • Engineering • Management

VOL. 122 No. 4

Features • • •

▼ National Motor Boat Show

New Developments in power plants for recreational boating are described by Charles A. Weinert. This article supplements the marine engine story that appeared in the January 15 issue of AUTOMOTIVE INDUSTRIES. Page 57

▼ Producing the Rolls-Royce Engine

Output at Rolls-Royce is relatively small and there are frequent changes in design. Versatility of equipment is important because some machines make up to 20 different parts in a week. David Scott is the author. Page 60

▼ SAE Annual Meeting

The first part of a report on activities at the Society of Automotive Engineers' annual meeting appeared in the February 1 issue of AI. This issue contains the second, and concluding, part of the report. Page 63

▼ Heat Treatment of Fuller Transmission Parts

Application illustrations accompany an interesting article that describes heat treating truck and tractor transmissions. Page 69

▼ Body Rust-Proofing at Chrysler

With the production of 1960 models, Chrysler Corp. has incorporated an extensive new rust-proofing system into its body-building operations. Page 70

▼ Metal Finishing in the Body-Building Plant

Applications of coated abrasives in automobile body plants are described in an interesting article by Joseph R. O'Neil, of the Carborundum Co. Various types and shapes of coated abrasive products are discussed. Page 72

▼ Preventive Maintenance Improves Quality in Modern Foundry

A thorough preventive maintenance program in effect at Pontiac Motor Division's foundry in Pontiac, Mich., is paying handsome production and quality dividends. Page 74

▼ Versatile New Vehicle

A newly developed unit that has many uses is described and illustrated in an interesting article. Page 76

▼ Spline Rolling of Axle Shafts

The results of cold roll-forming to produce splines on axle shafts and the Michigan Roto-Flo process at the Tractor and Implement Division of the Ford Motor Co. are covered in this article. Also given is quality control and tolerance information. Page 77

▼ 17 New Product Items, and Other Features Such as;

Farm Equipment, News of the Machinery Industry and a new feature . . . "Manufacturers' News."

MEMBER SOCIETY of BUSINESS MAGAZINE EDITORS

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NBP National Business Publications, Inc.

BPA Business Publications Audit of Circulation

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CORVAIR

TAKES ROUGH-RIDER ROADS IN STRIDE!

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GM Steel Tubing Engineers take every precaution to insure that this is *the cleanest tubing you can buy*, and automotive people find added assurance in the fact that GM Steel Tubing comes from America's largest manufacturer of refrigeration tubing. The same high standards apply to every piece of GM Steel Tubing regardless of end use. Ask a GM Steel Tubing Sales Engineer for all the details. *Rochester Products Division of General Motors, Rochester, New York.*

New CORVAIRS roll ruggedly over GM Proving Ground test roads, designed to torture the cars beyond what ordinary roads, however bad, will ever impose. CORVAIR takes it because of the care that goes into components before assembly.

GM STEEL TUBING BY ROCHESTER PRODUCTS

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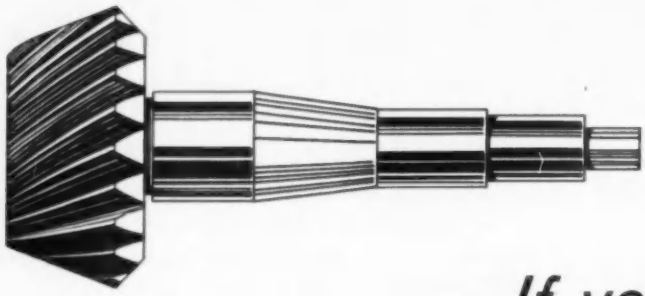
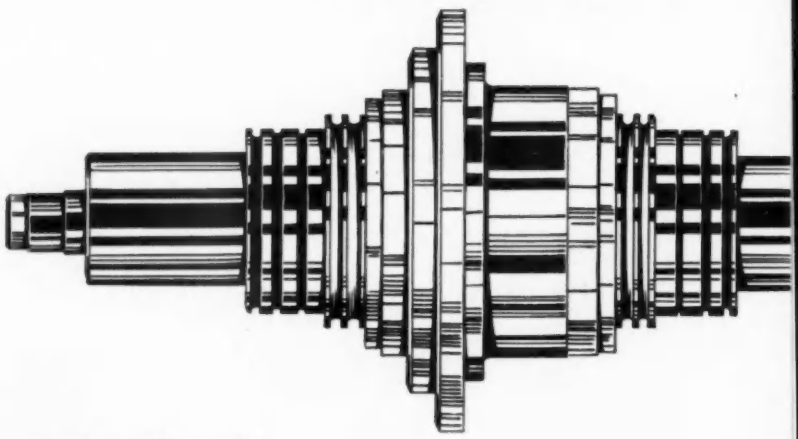
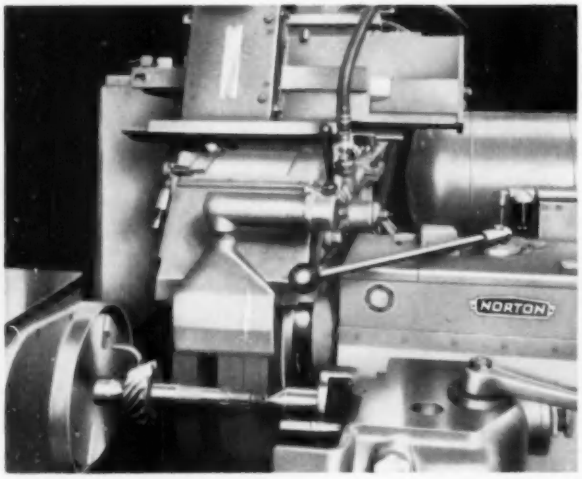


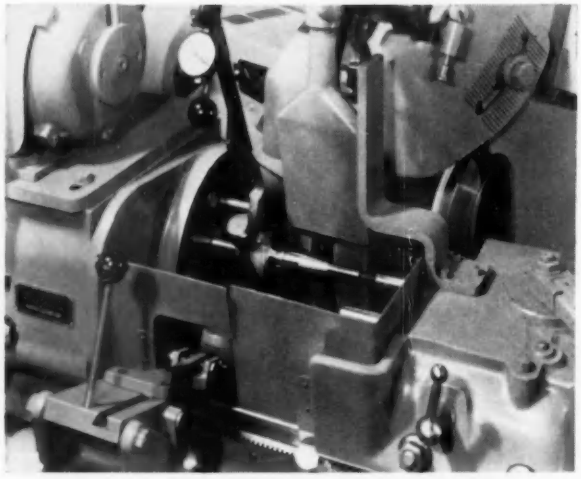
If you grind parts



combine your grinds in NORTON machines...like these



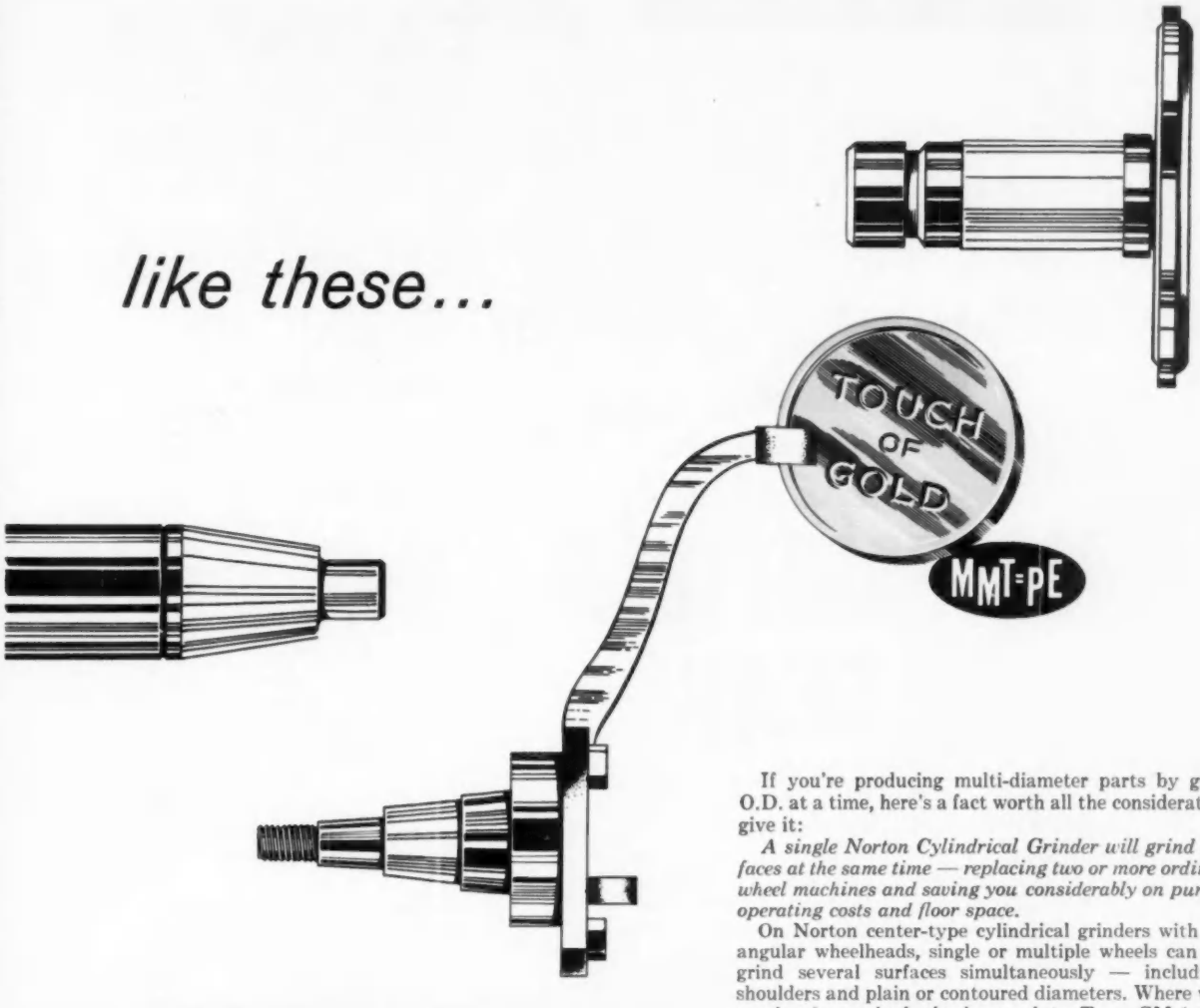
Grinding three stem pinion diameters on a Norton Type CTU Cylindrical Grinder. This multiwheel setup grinds three diameters in a single plunge cut, eliminating the need for separate operations. Norton automatic truing substantially increases the efficiency of multiwheel grinding.



Grinding a steering knuckle on a Norton Type CV-4 Angular Wheelslide Grinder with a dual wheel setup. Norton machines of this type offer unlimited opportunities to save time and effort when grinding several diameters, adjacent radii, and shoulders.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

like these...



Grinding multiple diameters on a crankshaft, this Norton Type CM-1 Multiwheel Grinder finishes the job in about the same time it would take a conventional machine to grind just one of these diameters. The massive wheel spindle holds a number of 36" wheels, properly spaced, within a wide span of 30".

If you're producing multi-diameter parts by grinding one O.D. at a time, here's a fact worth all the consideration you can give it:

A single Norton Cylindrical Grinder will grind several surfaces at the same time — replacing two or more ordinary single-wheel machines and saving you considerably on purchase costs, operating costs and floor space.

On Norton center-type cylindrical grinders with straight or angular wheelheads, single or multiple wheels can be used to grind several surfaces simultaneously — including tapers, shoulders and plain or contoured diameters. Where wider wheel spacing is required, the heavy duty Type CM-1 Multiwheel Grinder can be used to good advantage for high speed, high production O.D. grinding.

Among the many time-and-money-saving features engineered by Norton for these machines, push-button actuated automatic wheel truing is one of the most outstanding advancements. This device provides close, uniform control of the amount of wheel face removed by the truing diamond, and trues the wheel or wheels either straight or formed, with speed and precision.

Get further facts on how Norton cylindrical grinders are bringing new efficiency and economy to O.D. grinding throughout industry. Your Norton Man, a trained grinding engineer, will be glad to show how these multi-grind, multi-wheel machines can benefit your own production. NORTON COMPANY, Machine Division, Worcester 6, Mass.

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CALENDAR

OF COMING SHOWS AND MEETINGS

Autorama, Hartford, Conn ....Feb. 17-22

ASME Gas Turbine Power and Hydraulic Conference, Rice Hotel, Houston, Tex. .....Mar 6-9

Pacific Automotive Show, Denver, Colo. .....Mar. 10-13

SAE Passenger Car, Body and Materials Meeting, Sheraton-Cadillac Hotel, Detroit, Mich. .....Mar. 15-17

SAE National Production Meeting, Statler Hotel, Cleveland, O. Mar. 22-24

Material Handling Institute, spring meeting, Pittsburgh-Hilton Hotel, Pittsburgh, Pa. .....Mar. 29

American Power Conference, Hotel Sherman, Chicago, Ill. .....Mar. 29-31

Industrial Truck Association, spring meeting, Pittsburgh-Hilton Hotel, Pittsburgh, Pa. .....Mar. 30

Nuclear Congress and Atomic Exposition, Coliseum, New York, N. Y. .....Apr. 4-7

SAE National Aeronautic Meeting, Hotel Commodore, New York, N. Y. .....Apr. 5-8

SPI Western Section Conference, New Riviera Hotel, Palm Springs, Calif. .....Apr. 7-8

Air and Space Exposition, Sports Arena, Los Angeles, Calif...Apr. 14-24

International Automobile Show, Coliseum, New York, N. Y....Apr. 16-24

Annual Conference on Automatic Techniques, Cleveland-Sheraton Hotel, Cleveland, O. .....Apr. 18-19

SPI Cellular Plastic Div., Automotive Conference, Statler Hotel, Detroit, Mich. .....Apr. 20-21

ASME-SAM Management Conference, Statler Hilton Hotel, New York, N. Y. .....Apr. 21-22

ASTME Tool Show, Detroit Artillery Armory, Detroit, Mich..Apr. 21-28

American Society Mechanical Engineers, Maint. and Plant Conference, Chase-Park Plaza, St. Louis, Mo. .....Apr. 25-26

American Welding Society, 41st annual Meeting and Welding Show, Biltmore Hotel, Los Angeles, Cal. .....Apr. 25-29

American Foundrymen's Society, Castings Congress and Exposition, Convention Hall, Phila., Pa. .....May 9-13

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HYDRA-DRIVES®

POWER SHIFT TRANSMISSIONS and TORQUE CONVERTERS

Rockwell-Standard's Hydra-Drives units make hard work easy for heavy-duty equipment. The result . . . smooth, efficient, economical operation. A torque converter and 4-speed transmission in one compact package, the Hydra-Drives Power Shift Transmissions have been proved in hundreds of vehicles. They eliminate engine lugging and heavy shock loads. A 3-to-1 torque multiplication makes starting fast and effortless—even with heaviest loads.

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With four speeds forward and reverse, the Hydra-Drives Power Shift Transmissions are ideally suited for vehicles which must travel in both directions during a normal work cycle.

Hydra-Drives Torque Converters are the simplest, most efficient made. They can be matched with any transmission for easier, more efficient operation.

HYDRA-DRIVES BDB Transmission

- Four speeds forward and reverse.
- Full power shifting.
- For equipment up to 175 h.p.

HYDRA-DRIVES CDB Transmission

- Four speeds forward and reverse.
- Power shift in each range both forward and reverse.
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HYDRA-DRIVES Torque Converter

- 3-to-1 torque multiplication.
- Available separately, or with Hydra-Drives Transmission.
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HYDRA-DRIVES

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TRANSMISSION AND AXLE DIVISION
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Take a cost-wise look at your assembly operations,

and you'll see that fasteners

represent real money. To make sure

it is money saved—not lost—

count on *Continental*

MORE TYPES OF FASTENERS Continental Assembly Specialists are unbiased toward any particular types . . . Continental makes all types. The fastener they recommend for your job is the one proved best by careful cost analysis.

MORE STANDARDS IN STOCK Continental can supply any recognized standard type, style or size. Also, many fasteners ordinarily considered "specials" are available among the millions of screws constantly in stock to meet needs of Continental customers.

MORE "SPECIAL" EXPERIENCE Continental is known throughout industry as the "specialist in specials," — leads in production of special designs. Continental is also your supply source for special-purpose fasteners, such as HOLTITE NYLOK Self-locking Screws.

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Let Continental Assembly Specialists analyze your operations and help you find cost-saving opportunities that are often overlooked. You'll see why fastener users everywhere agree, "*You can count on Continental.*" Write or phone: Continental Screw Co., 451 Mt. Pleasant St., New Bedford, Massachusetts.

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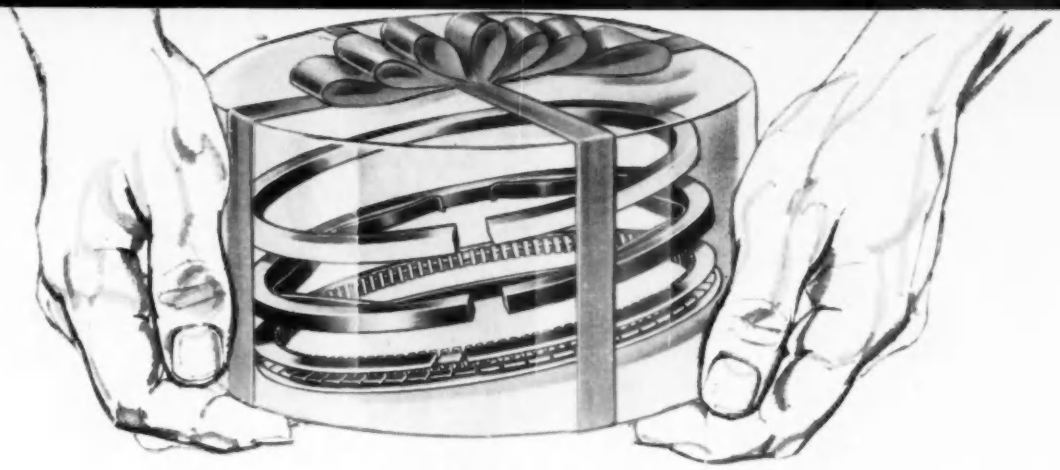
Circle 110 on Inquiry Card for more data

Circle 111 on Inquiry Card for more data →



give the *gentleman* what he wants...

the complete package

When the *gentleman,* the great automotive industry, calls for piston rings, Thompson Products RAMCO DIVISION gives him ***the complete package.*** That package includes piston ring engineering facilities backed by the world-renowned Thompson Ramo Wooldridge organization; it includes precision, capacity and delivery insurance that only the world's most modern ring plant could deliver. Such a plant is the new Ramco Division Plant in Manchester, Missouri. We'd like to have you see this plant in person, or if you can't, through our new booklet, "Most Modern Ring Plant." May we send you a copy?

Piston Rings by **THOMPSON PRODUCTS RAMCO DIVISION**

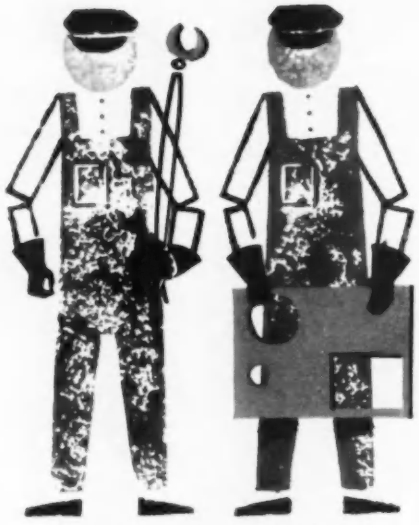
Thompson Ramo Wooldridge Inc. • P. O. Box 513
Dept. H, St. Louis 66, Mo.

AUTOMOTIVE GROUP

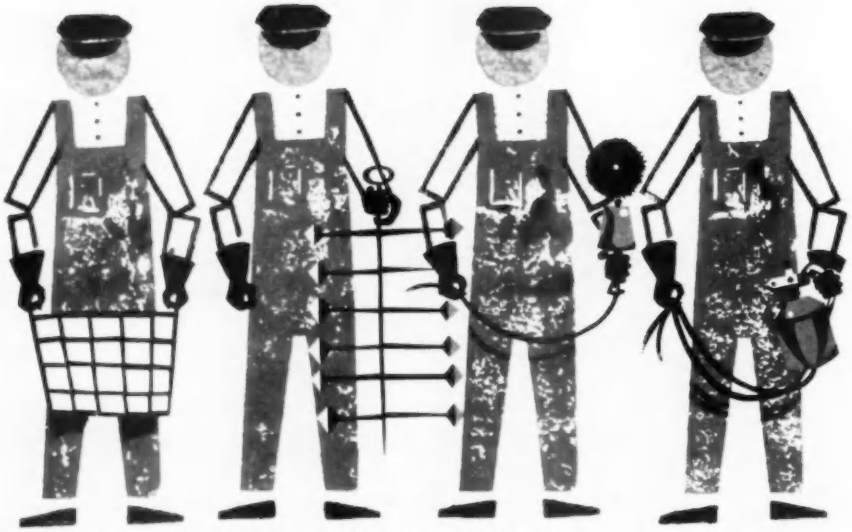
THOMPSON PRODUCTS LIGHT METALS DIVISION | THOMPSON PRODUCTS MICHIGAN DIVISION | THOMPSON PRODUCTS VALVE DIVISION | THOMPSON PRODUCTS RAMCO DIVISION | THOMPSON PRODUCTS MOTOR EQUIPMENT MANUFACTURING DIVISION

Copyright 1960 Ramsey Corporation M-815

ALL UNDER ONE ROOF AT BROWN-LIPE-CHAPIN



DIE CASTING METAL STAMPING



ANODIZING NEW DURA-PLATE ELECTROPLATING POLISHING PAINTING

Everything's done on virtually one continuous assembly line—from die casting or metal stamping to the gleaming finished part.

Every process is under one roof: Extensive facilities for precision die casting parts of any shape and sizes up to six feet in length . . . an array of presses for stamping parts of any metal . . . complete facilities for rolled sections . . . and efficient assembly line processes for polishing, anodizing, painting and electroplating with new Dura-Plate.

Two plants, strategically located in Syracuse, New York and Elyria, Ohio, offer the same complete, under-one-roof facilities to speed delivery of your parts to meet your schedules right on time. So whatever your product, write or phone Brown-Lipe-Chapin, Syracuse, New York for prompt information.

GM GENERAL MOTORS RELIABILITY by BROWN·LIPE·CHAPIN BLC

DIVISION OF GENERAL MOTORS CORPORATION

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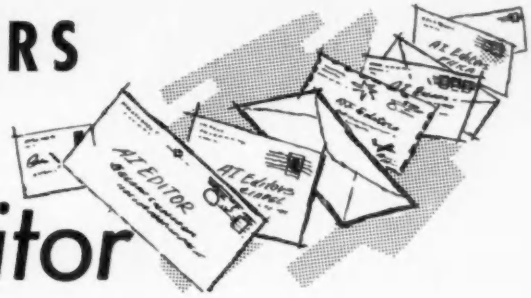
LETTERS to the Editor



Readers' opinions or requests for additional information on material appearing in the editorial pages of AUTOMOTIVE INDUSTRIES are invited for this column. No unsigned letters will be considered, but names will be withheld on request. Address *Letters to the Editor*, AUTOMOTIVE INDUSTRIES, 56th & Chestnut Sts., Philadelphia 39, Pa.

LOOKING BACK

Thank you for sending your best wishes in connection with my new job. This is very much appreciated.

Whenever I see a letter from the Chilton Publications, I become positively nostalgic. As a youngster, I lived at 20 N. 50th St. in Philadelphia. I can well remember when I crawled over the girders and beams when Chilton built their first plant, as I recall at 49th and Market Sts.

I was personally involved in the discovery of the use of waterproof sandpaper for rubbing out rough stuff and rubbing varnish in the automotive industry and refinish shops. I recall that I learned very early back in 1921 that your magazine was the publication that catered to this trade. I believe our first ad was placed in your magazine, which we have used ever since. So you see I have a good recollection of many things concerning Chilton and thus appreciated your letter accordingly.

J. C. Duke
Executive Vice President
Minnesota Mining & Mfg. Co.
St. Paul 6, Minn.

WORK HANDLING

We are shortly going to press on a new report "Applications of Work Handling Equipment to Pressworking Operations."

We would like to use an illustration which appeared as Fig. 1 on page 43 in an article entitled "Automatic Press Feeder Increases Output and Eliminates Hazards" in the May 15, 1952, issue.

We would greatly appreciate a whole plate block-making print of this illustration, a photocopy of which is attached.

J. E. D. Bell
Publications Section Head
Production Engineering Research Association of Great Britain
Melton Mowbray
Leicestershire, England

● *Sorry, but we don't keep old photographs this long.—Ed.*

TRUCK ENGINES

We certainly appreciate the coverage you gave our new engines in your August 15 issue. We have had several comments on the publicity which has been given this new engine design in many publications to the trade.

R. T. Jennings
Merchandising Mgr.
Truck Division
GMC Truck & Coach Div.
General Motors Corp.
Pontiac, Mich.

PRODUCTS GUIDE ISSUE

We are very much interested in the 1960 Products Guide published in the Dec. 15, 1959 issue. It will be a big help to our Engineering Department in securing new vendors.

We would appreciate a copy of the guide which we may place in our file so that it would be readily available and accessible to the Department.

J. E. Kachnik
Assistant Chief Engineer
J. I. Case Co.
Churubusco Works
Churubusco, Ind.

● *Copy is being sent to you.—Ed.*

FOR EASIER HANDLING

STANDARDIZE 100% ON SOUTHERN FASTENERS

For materials movement that is power-driven, mechanical or manual, it will pay you to standardize 100% on Southern fasteners. Southern Screw's proven, industry-acclaimed pallet system for bulk fastener movement and storage promotes multiple advantages that show up on the profit side of your books.

And there's no extra charge for this Southern service. Your bulk fastener shipments arrive on 30" x 30" two-way entry disposable pallets to which are steel strapped 36 heavy-duty bulk cartons, each 9" x 9" x 6½". Individual cartons are 275# test corrugated board, with telescopic top. Thus you can use each carton at two different production line stations.

Cash in now on these and many other advantages of standardizing 100% on Southern fasteners for more profitable operation. Southern screws are 100% USA-made of finest quality USA materials.

Ask for Southern's new bulk package chart BP-2 when you send your order or inquiry to Southern Screw Company. P. O. Box 1360, Statesville, N. C.

Manufacturing and Main Stock in Statesville, North Carolina

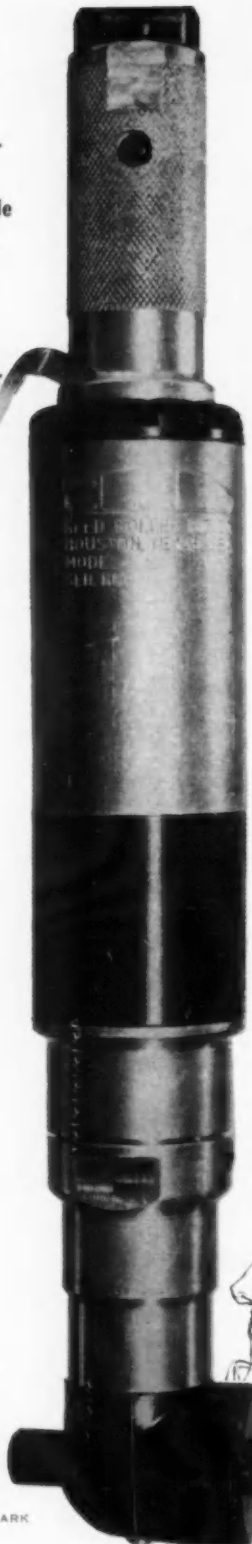
Warehouses: New York • Chicago • Dallas • Los Angeles

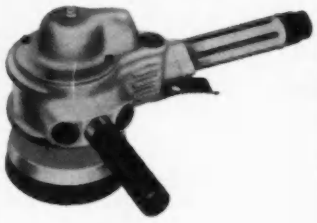
Machine Screws & Nuts • Tapping Screws • Wood Screws • Stove Bolts • Drive Screws • Hanger Bolts • Carriage Bolts • Dowel Screws

Southern SCREW COMPANY STATESVILLE • NORTH CAROLINA

Circle 113 on Inquiry Card for more data

Cleco air tools range in type and size from a small precision die grinder (length: 4⅞ ins. — weight: 12 ozs.) to custom-designed multiple spindle assembly units. This complete line includes Cleco's amazingly unique Clecomatic* screwdriver — nut-runners and nutsetters. The completely automatic air tools with positive torque control!





Cleco air tools are as quiet, as light weight, as economical, and as maintenance free as a tool can be and still do the job it was designed to with more efficiency than its rated capacity calls for. This is a true characteristic of Cleco Tools . . . their job performance usually exceeds your most critical demands.

To see how well a Cleco production-proved tool can do your job, call your Cleco® representative for a demonstration-tryout.

CLECO
AIR TOOLS

*TRADEMARK

A Division of REED ROLLER BIT COMPANY • P. O. BOX 2119 • HOUSTON 1, TEXAS

Circle 114 on Inquiry Card for more data

Circle 115 on Inquiry Card for more data ➔

For new design flexibility . . . beauty . . . long life!

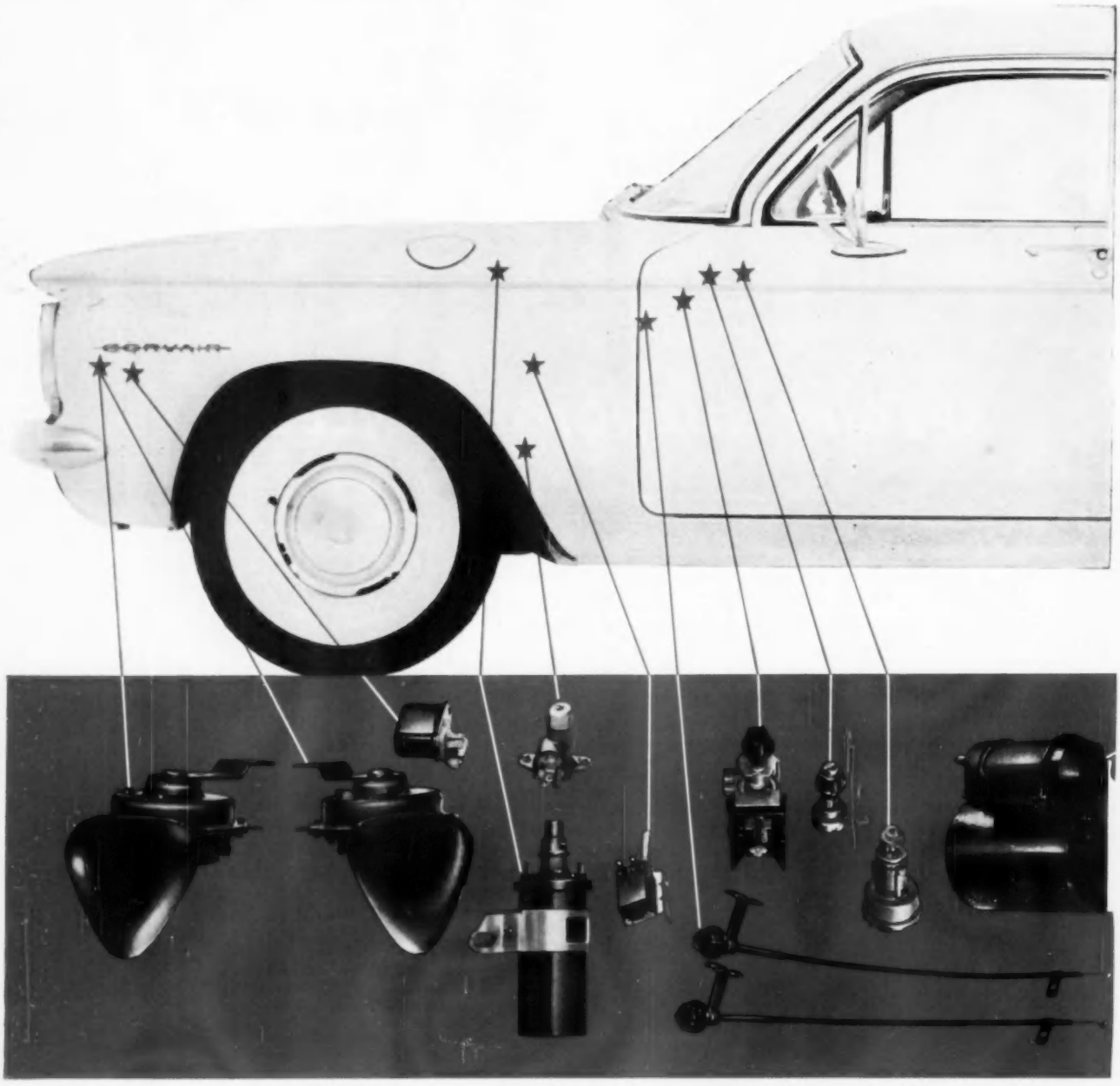
SPECIFY SHARON STAINLESS

Sharon Stainless Steels have proved through use to be of consistent high quality, uniform, bright and smooth with a dense finish. For both interior and exterior fittings you will find Sharon can supply your need exactly with the tolerance, drawing ability and finish your product requires for greatest appeal and durability.

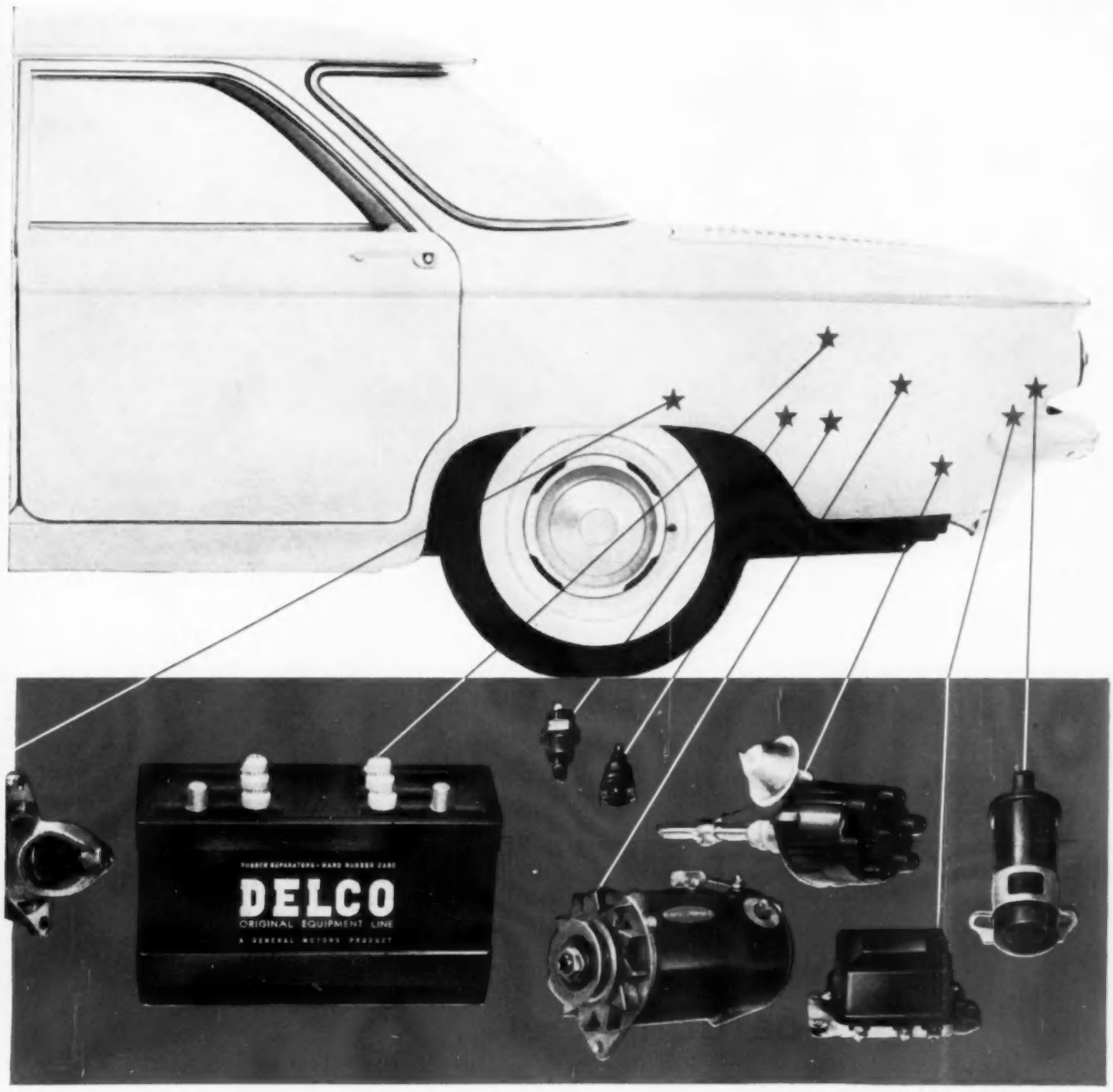
Consider too, Sharonart*, Sharon Steel's exciting new rolled-in surface patterned steel—opening a new breadth of design flexibility for the automotive designer. Sharonart*, made of stainless steel will reflect an infinite variety of color and texture combinations. Many beautiful patterns available.

For the stainless you need to make your product better—get in touch with your Sharon representative—or write us direct. **Sharon Steel Corporation, Sharon, Pa.**

SHARON *Quality* **STEEL** SHARONSTEEL



Two outstanding achievements for 1960:
New compact Corvair by Chevrolet!
New compact electrical equipment
by Delco-Remy!



Delco-Remy has contributed importantly to the new Corvair by Chevrolet. New, lightweight, high-performance electrical components were specially designed by Delco-Remy for this revolutionary car. Traditional cooperation between engineering groups rapidly resolved the many problems of weight and space.

The new Corvair equipment by Delco-Remy includes • Generator • Regulator • Cranking Motor • Distributor • Ignition Coils • Horns • Flexible Cable Controls • Directional Signal and Control Switches • and Delco Battery.

Delco-Remy

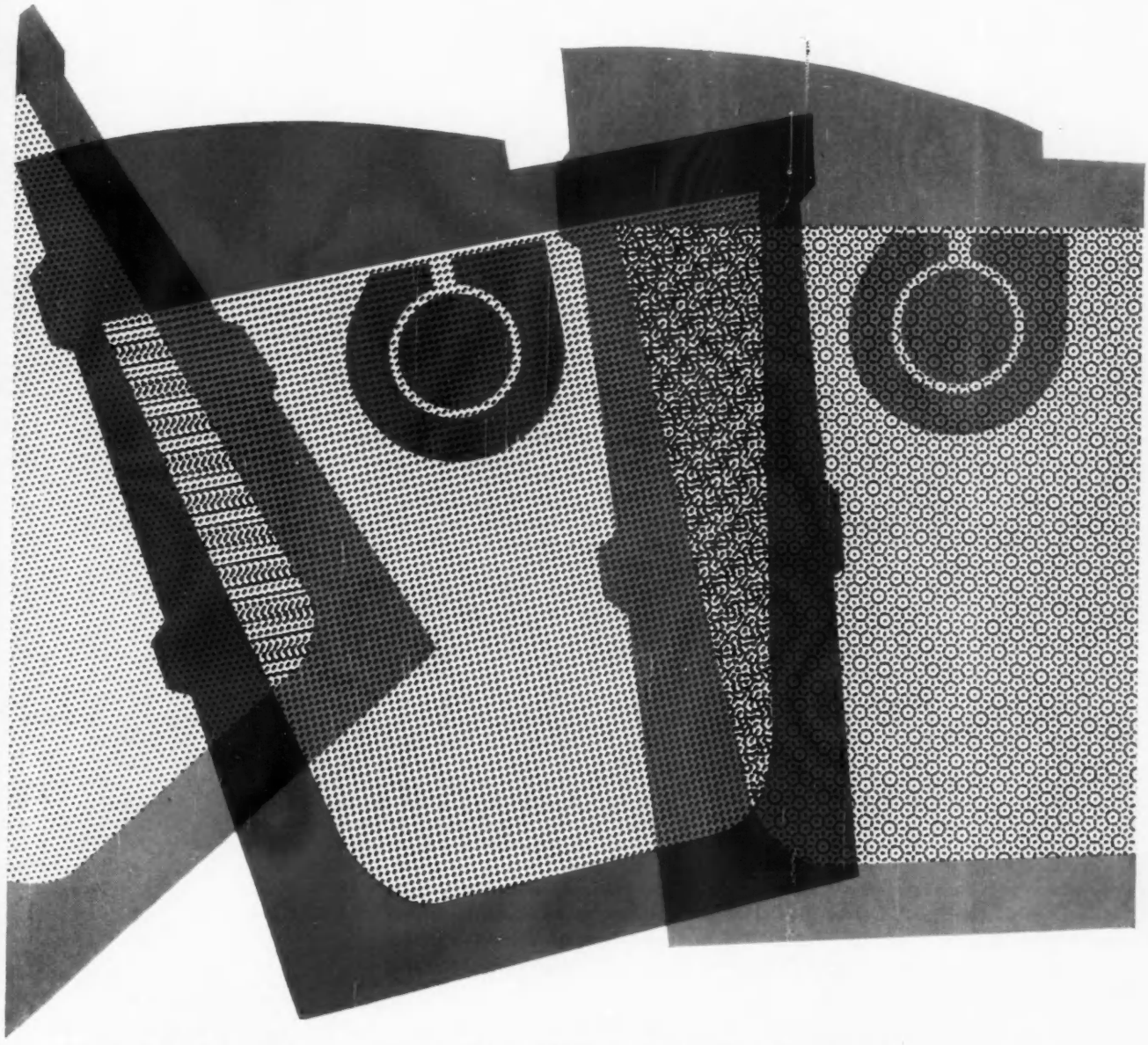
From the highway to the stars

DIVISION OF GENERAL MOTORS, ANDERSON, INDIANA

Circle 116 on Inquiry Card for more data

Columbium
makes possible
this unique
new
fine-grained
carbon steel

GLX-W



Compare fine-grained GLX-W with the steel you use

Great Lakes adds a precise amount of columbium to good-quality carbon steel. The result is fine-grained GLX-W steel. Here's how GLX-W compares with mild carbon steels . . .

- GLX-W is 50-100% stronger
- Has greater notch toughness
- Has excellent weldability
- Is as ductile as other carbon steels
- Permits designers to reduce weight up to 35%.

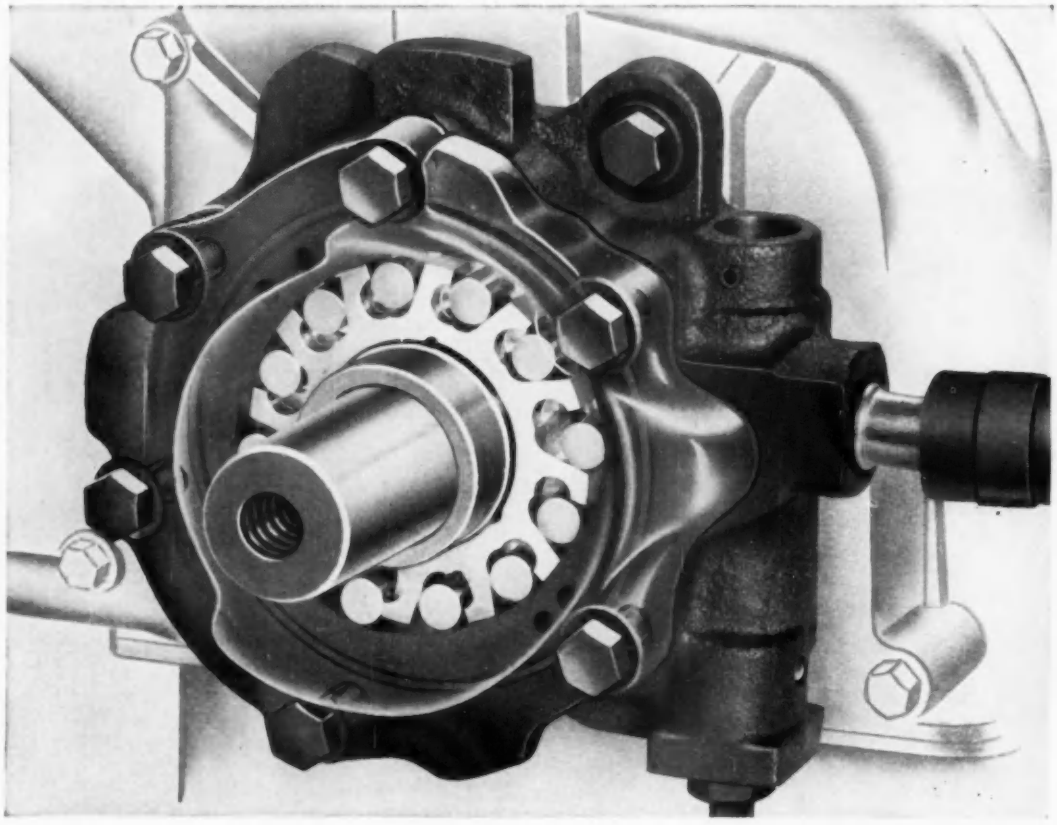
For proof on how GLX-W can cut your production costs, write, wire or phone Great Lakes Steel Corporation, Product Development Division, Department J.

GLX W **GREAT LAKES STEEL**
Detroit 29, Michigan

Great Lakes Steel is a Division of **NATIONAL STEEL CORPORATION**

Circle 117 on Inquiry Card for more data

MORE SPACE FOR ACCESSORIES



with the Eaton Crankshaft-Driven Power Steering Pump

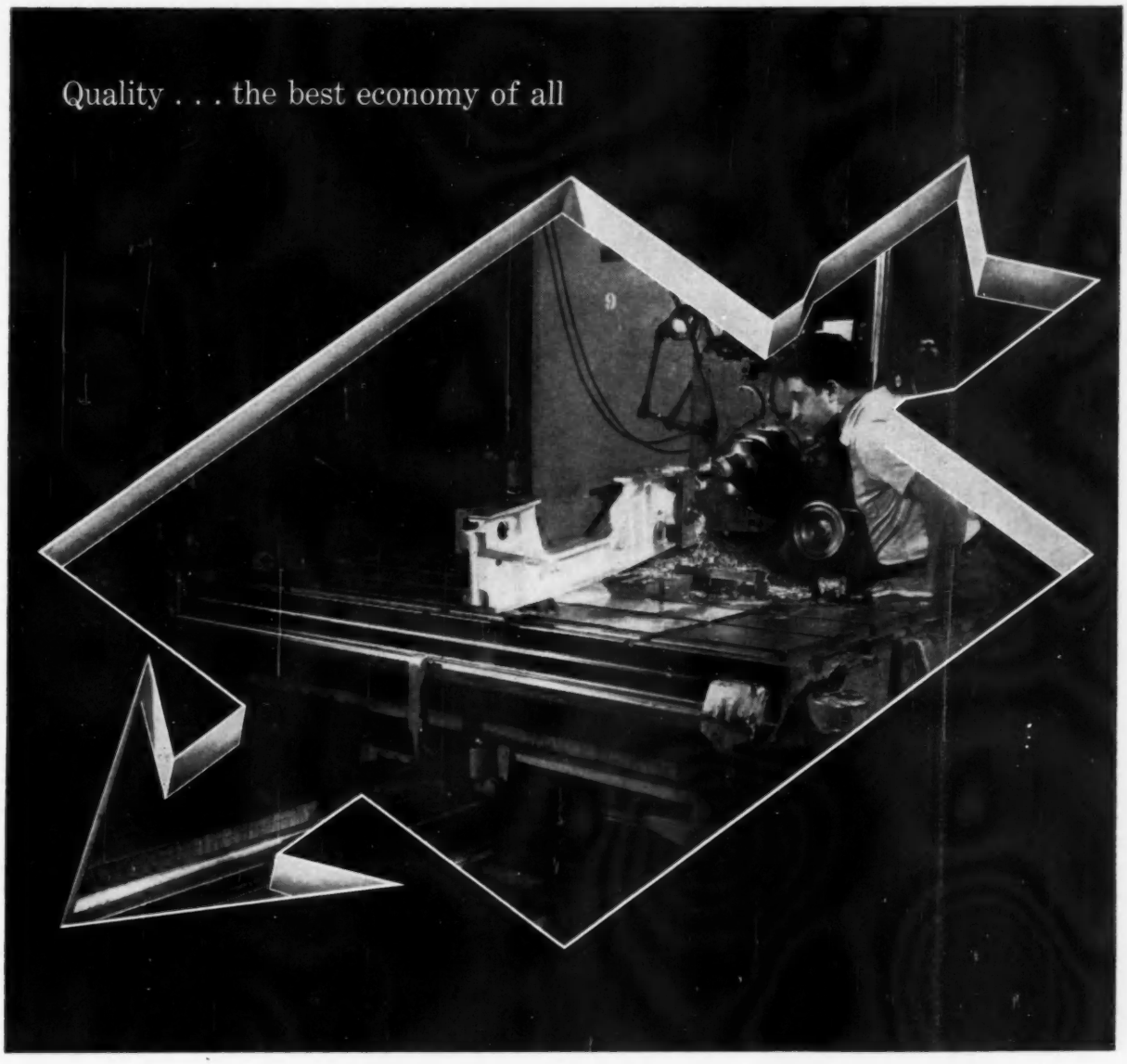
By eliminating the need for mounting brackets, pulleys, and v-belts, the Eaton Direct Crankshaft-Driven Power Steering Pump saves valuable under-hood space. The oil reservoir is remotely mounted—out of the way. Direct crankshaft drive provides power for steering under all conditions; eliminates the need for belt adjustments.

The Eaton Crankshaft-Driven Pump is an advanced version of the basic Eaton Roll-Pump design which has been performance-proven in operation on many leading passenger cars, motor trucks, and tractors. High efficiency, dependability, quiet operation, and low cost maintenance are tangible benefits inherent in this design.

If you are concerned with improving steering performance while cleaning up engine front end design and gaining additional under-hood space, call on us. Your inquiry will receive immediate attention.

EATON

EATON
PUMP DIVISION
MANUFACTURING COMPANY
9771 FRENCH ROAD • DETROIT 13, MICHIGAN



Fight the cost of "Stick-Slip" with Sunoco Way lubricant

"Stick-slip", the alternate grabbing and releasing of slow-moving carriages, can seriously score machine ways and ruin fine workpiece finishes.

Avoid this trouble and expense with Sunoco Way Lubricant, known throughout the world for its ability to cure "stick-slip". Special ingredients in Sunoco Way Lubricant form a durable, reinforced lubricating film along the mating surfaces. Result: There is no metal-to-metal contact even during week-end shutdowns; machines start easily; carriages move without intermittent grabbing. YOU GET FINER FINISHES, FEWER REJECTS.

Ask your Sun representative to show you how others have benefited by using Sunoco Wav Lubricant. Or write to Dept. **AA-2.** SUN OIL COMPANY, *Philadelphia 3, Pa.* In Canada: Sun Oil Company Limited, Toronto and Montreal.

SUNOCO

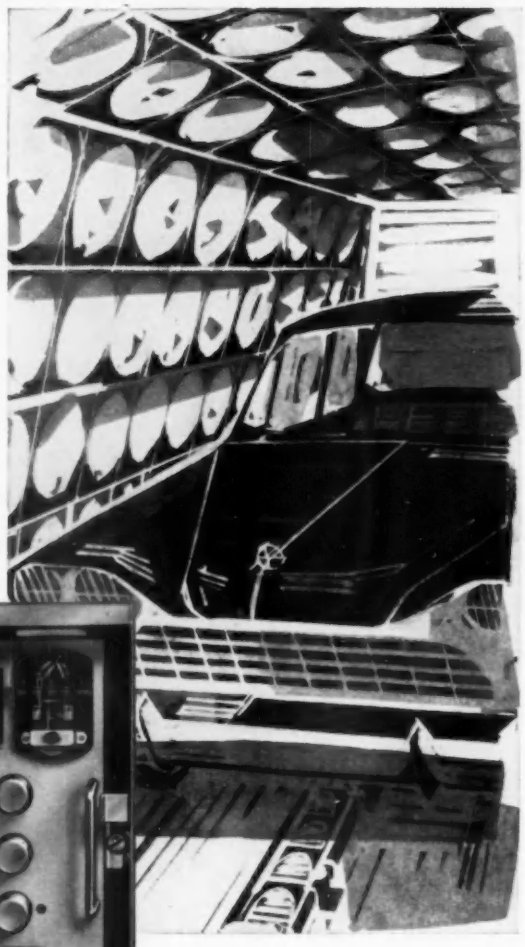
MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

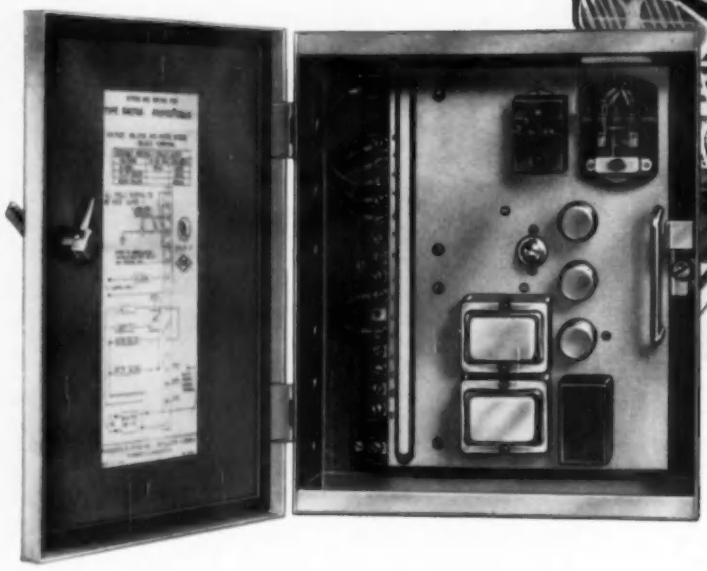
Circle 118 on Inquiry Card for more data

from Honeywell... ANOTHER DIAMOND JUBILEE PRODUCT

Honeywell is first with the only fail-safe flame safeguard!

New maximum-safety, self-checking relay prevents losses due to burner safeguard failure and resulting explosions.





The Honeywell Protectoglo* Relay offers you the most fail-safe protection yet devised for industrial burner safeguards—truly an important break-thrqugh in the art of flame safeguarding! Never before has a flame safeguard offered you such low-cost assurance against explosions and downtime. Compared to the Honeywell R4075, all other continuous process flame safeguards are obsolete!

In other flame safeguards, safe-start, self-checking networks operate *only during start up or recycling*. The new R4075 unit operates constantly. It will cause an immediate safety shutdown and sound an alarm if the sensing signal, amplifier or related circuitry fails *at any time* while the burners are operating or during start ups or shutdowns. This same self-checking circuit checks all components of the Protectoglo system including the flame rod once *every* second. You get maximum protection, not only on safeguard systems for constantly burning gas burners using flame rods, but also on gas- or oil-fired systems using Ultra-Vision flame detectors. For information on how the Honeywell R4075 can help your industry, call your nearest Honeywell office; or write: Minneapolis-Honeywell, Dept. AI-2-30, Minneapolis 8, Minnesota.

*Trademark

Honeywell

75th YEAR — PIONEERING THE FUTURE

H HONEYWELL — First in Control — SINCE 1885

Circle 119 on Inquiry Card for more data

TORQUE TALK ABOUT CLARK® EQUIPMENT

WORLD'S WINNINGEST HORSE protected by Clark Air Ride

This horse rides in regal style—and why shouldn't he? He's Round Table and he's won over $1,500,000 so far in his racing career—more than any horse in history. His "chariot" rides smoothly on Clark Air Suspension.

This Suspension was chosen by the trailer manufacturer, Aluminum Body Corporation, Montebello, California, principally to swallow the shocks of high-speed travel. Clark Air Suspension also controls sway on curves . . . automatically keeps trailer level when loads are unbalanced . . . prevents "wheel-hop" when stopping.

If you haul fragile cargo of *any* kind—horses or precision instruments, cameras or cookies—it will pay you to investigate Clark Air Suspension. Besides load protection, you'll get the pluses of lighter vehicle weight . . . less maintenance . . . and longer tire life. Drop us a postcard for full details.

TESTS FOR U.S. NAVY SHOW CLARK AIR RIDE CUTS ROAD SHOCK 70%

When the U.S. Navy put together this traveling air training "school," some method of protecting a trailer full of delicate machines and instruments had to be found.

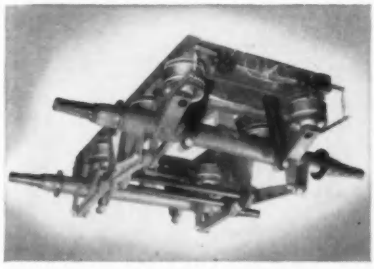
The Navy selected a trailer built by The Gerstenslager Company with Clark Air Suspension.

This choice was made after painstaking road tests had shown that a trailer equipped with ordinary leaf

springs transmits up to 5½ "g's" of shock to the cargo. Coil springs cut this "bounce" to 2½ "g's". Clark Air Ride reduces it to 1½ "g's", well within the margin of safety desired by the Navy engineers and less than any other air suspension tested.

CLARK AIR SUSPENSIONS

come as complete packages, ready for installation on new or in-use semis, in single or tandem units. Each "package" includes the frame structure, air springs, shock absorbers, torque rods, radius rods, air protection filters, and leveling valves.



For Further Information

and full details on any of Clark's automotive components, simply address a card or a call to:

CLARK EQUIPMENT COMPANY
AUTOMOTIVE DIVISION
Buchanan 2, Michigan

Circle 120 on Inquiry Card for more data

Engineers:
Here are sound reasons why it pays to specify
USS National Seamless Mechanical Tubing

USS National Seamless Steel Mechanical Tubing offers you extraordinary freedom of design in a wide range of products from bushings to hydraulically operated telescoping booms. And, USS National Seamless Tubing helps cut processing costs, because it eliminates drilling operations; enables you to replace drills with simple, less expensive boring tools, and it reduces tool wear and tool changes; and, more important, more uniform parts can be turned out by the hundreds of thousands.

Where USS National Seamless Tubing is used as a load-carrying member or part, it exhibits a number of structural advantages over other forms. *Here are a few:* it gives you a superior cross section when a part is designed to withstand equal loading in any direction; it resists bending stresses equally in all directions; it is able to absorb and localize shock; and in torsion, it provides better material distribution, and for a given weight, can withstand more load than other sections.

And, of course, the name USS National is backed by the world's largest and most experienced manufacturer of seamless tubing—National Tube! The production of USS National Seamless Tubing, from ore to finished product, is entirely controlled by one organization. There is no divided responsibility. Every foot, every length, is made under the careful supervision of skilled men with years of tubemaking experience. For more than 60 years, USS National Seamless Tubing has been first with men who want the best in mechanical tubing.

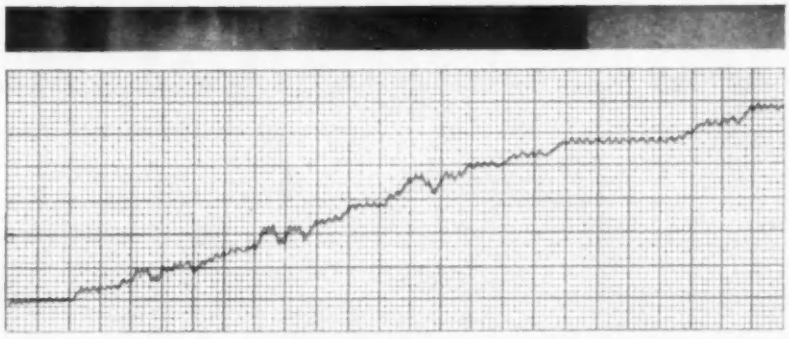
You'll find USS National Seamless Tubing available at select National Tube Distributors throughout the country. These distributors are strategically located and expertly trained in solving all types of tubing problems. Here, you can choose from a complete range of sizes and stocks. If you'd like to find out how USS National Seamless Tubing can be most effectively applied to your designs, contact your nearest USS National Distributor . . . *soon!*

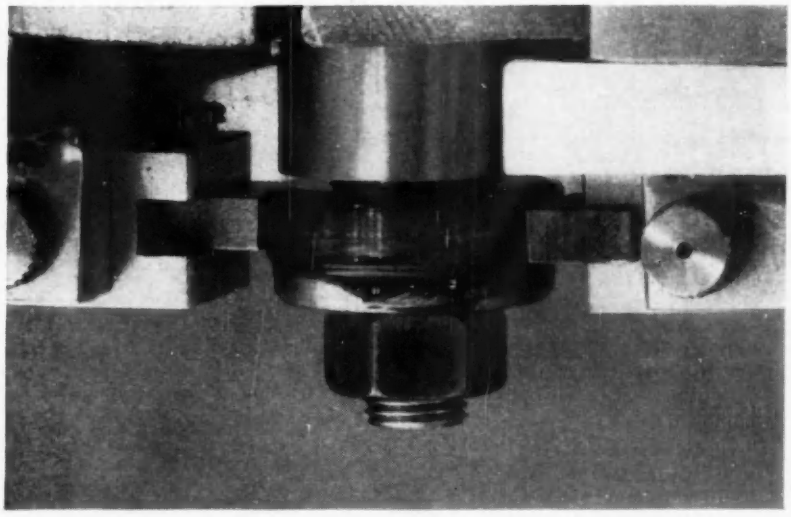
USS and National are registered trademarks

National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Supply Division
United States Steel Export Company, New York

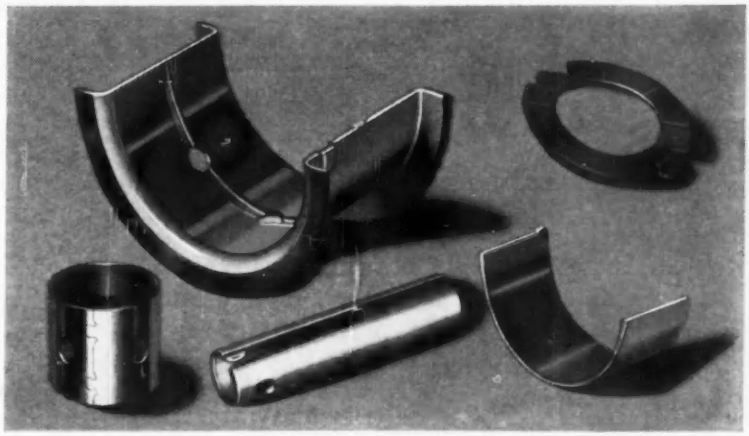
WE TAKE THE PULSE OF BEARINGS ON TAPE TO MAKE THEM EVEN BETTER!





TO TAPE-RECORD THE "HEARTBEAT" OF BEARING METALS UNDER LOAD, WE USE THIS SPECIAL FRICTION AND WEAR TESTER. (left) The result is highly accurate data on the behavior of bearing-metal surfaces, invaluable in our fundamental research into friction. By means of this instrument, we're able to correlate, more closely than ever before, specific alloy compositions with their degree of the "stick-slip" phenomenon (in which one surface sliding over another slides . . . stops . . . slides . . . stops . . . and so on) which accompanies unlubricated sliding action. We can also determine accurately the compatibility of bearing materials with shaft metals in lubricated systems . . . showing us which metal or alloy is most likely to be superior for a given bearing application. In short, this Friction Tester is a fundamental research tool which gives us positive answers to difficult bearing problems, faster than ever before.

ONE REASON WHY F-M SLEEVE BEARINGS and other F-M products give you the finest possible performance — this and the other unusual precision equipment used by Federal-Mogul research. You'll find F-M sleeve bearings used in turbines, engines, and countless other types of power transmission equipment . . . F-M precision thrust washers in pumps, automotive engines and transmissions, motors . . . F-M formed bushings in refrigeration compressors, electric motors . . . and low-cost F-M spacers in motor mounts, machinery, control mechanisms. These are just a few examples.



There's much valuable data in our Design Guides on sleeve bearings, thrust washers, and bushings; and in our brochure on spacers. For your copies, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11037 Shoemaker, Detroit 13, Michigan.

FEDERAL-MOGUL

sleeve bearings
bushings-spacers
thrust washers

DIVISION OF
FEDERAL-MOGUL-BOWER
BEARINGS, INC.

SPICER RUBBER ELEMENT SOLVE YOUR TORSIONAL

If you are faced with the problem of torsional vibration from impulses within the operating range, Dana engineers may be able to help you solve your design problems.

Spicer resilient propeller shaft assemblies have been used successfully for years in rapid transit cars, street cars, engine dynamometer, truck, bus, earthmover and passenger car applications to solve difficult torsional problems.

Spicer rubber-cushioned shafts make it possible for design engineers to "tune out" the vibration and thus produce commercially acceptable installations.

Spicer rubber-cushioned propeller shafts offer these additional advantages:

1. The torsional flexibility limits the effect of high impact loads resulting from rough shifts and other sudden torque changes.
2. The cushioning effect prevents clatter, rattle, and backlash noises.
3. Increased life of bearings, gear teeth, splines, and other components due to the reduction of high impact and torsional loads.
4. Reduction of noise transfer.
5. Axial flexibility to cushion forces resulting from length changes.

International 295 Payscraper, equipped with a Spicer rubber element shaft, at work on the Interstate Highway System.

Product knowledge and years of experience are available to you through Dana engineers to help solve your torsional problems. Contact them today.

SHAFTS CAN HELP YOU RESONANCE PROBLEMS

DANA Spicer

DANA CORPORATION

Toledo 1, Ohio

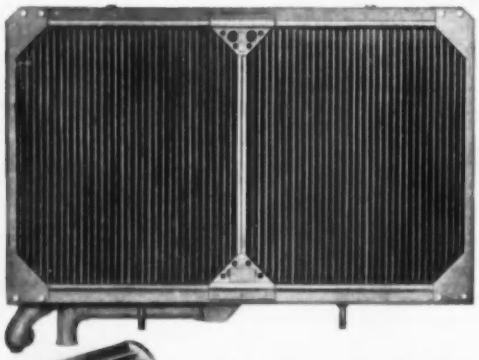
Serving Transportation—Transmissions • Auxiliaries • Universal Joints • Clutches • Propeller Shafts • Power Take-Offs • Torque Converters • Axles • Powr-Lok Differentials • Gear Boxes • Forgings • Stampings • Frames • Railway Drives

Many of these products are manufactured in Canada by Hayes Steel Products Limited, Merritton, Ontario

Circle 122 on Inquiry Card for more data

Young cools new highway giants!

New White 5000 TD
Diesel Powered
Super Hauler Tractor



Shown above is the Young-engineered, heavy duty MONOWELD® Radiator and replaceable cartridge-type Oil Cooler designed as cooling components on the new White 5000 TD diesel-powered highway tractors. The radiator's fully soldered, double lock-seam tubes increase core strength. Full wrap-around side members secure tanks, headers, and cores as one rugged unit. Fin design provides excellent bond, maximum air turbulence and heat transfer.

Young RADIATORS and LUBE OIL COOLERS are used *"where the going is tough"*

Manufacturers of these highway giants specify Young jacket water cooling radiators and lube oil coolers where the cooling requirements are really "tough" . . . cooling components that are dependable, efficient, rugged . . . that can take it "when the going it tough!" Long hauls in rugged terrain, steep mountain grades or torrid desert conditions present no cooling problem for trucks equipped with Young-designed heat transfer equipment.

For heat transfer performance that fills your most exacting requirements, look to Young . . . most used by the greatest names in truck manufacturing.

Heat Transfer Specialists for the original equipment market

Young offers over three decades of design and manufacturing experience in cooling radiators for internal combustion engines . . . your assurance of efficient cooling and trouble-free performance. Types of construction include sheet metal, cast iron and welded steel, available with either stationary or removable one-piece cores. Cast iron and welded steel types are also made with removable-section cores for quick, easy cleaning or replacement in event of damage.

Write Dept. No. 100-B for
New General Catalog No. 160
showing a complete line of
Young Heat Transfer Products.

Young

ideas for solving heat transfer problems are GOOD ideas

YOUNG RADIATOR COMPANY

General Offices, Racine, Wisconsin

Plants at Racine, Wisconsin and Mattoon, Illinois

Circle 123 on Inquiry Card for more data

American Pioneers of Progress

AMBITION IS THE SPUR
THAT MAKES MAN STRUGGLE
WITH DESTINY

DONALD G. MITCHELL

CARTER CARBURETOR

DIVISION OF ACF INDUSTRIES, INCORPORATED • ST. LOUIS 7, MISSOURI

Monautronic V-2 welding quality, cuts rejects and

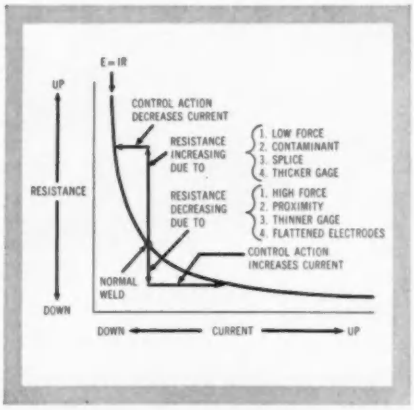
The new Monautronic V-2 welding control introduces the concept of feedback control to produce spotwelds of consistently high quality. It makes use of the latest advances in electronic computing to overcome automatically such obstacles to weld quality as line voltage fluctuation, electrode wear, variations in electrode tip force, surface finish and shunting.

The Monautronic V-2 compensates for undesirable variations usually encountered in resistance welding by maintaining voltage across a weld at a constant value. This constraint of voltage amounts to constraint of final weld temperatures, and such temperature control assures production of quality welds.

- **Automatic lockout**—occurs when process variations are so severe that the available current range would not cover the requirements for quality welding. The control detects extreme contamination, failure in the force system, overwelding, poor matching or fitup, and any other conditions that would result in substandard welds.
- **Automatic sequencing**—all provisions for single spot, roll spot or seam welding. Sequencing is 100% accurate, and exceeds NEMA standard specification 3B. Special sequence programming is available.
- **Transistorized design**—for high reliability, compactness, low power consumption.
- **Modular construction**—permits easy removal of the three modules and separate firing unit, simplifies maintenance.
- **Shock and vibration resistant construction**—for long, reliable service in even the most demanding applications.
- **Safety interlock**—for protection of personnel during tip dressing.
- **Tamperproof case**—prevents access to control by unauthorized personnel.

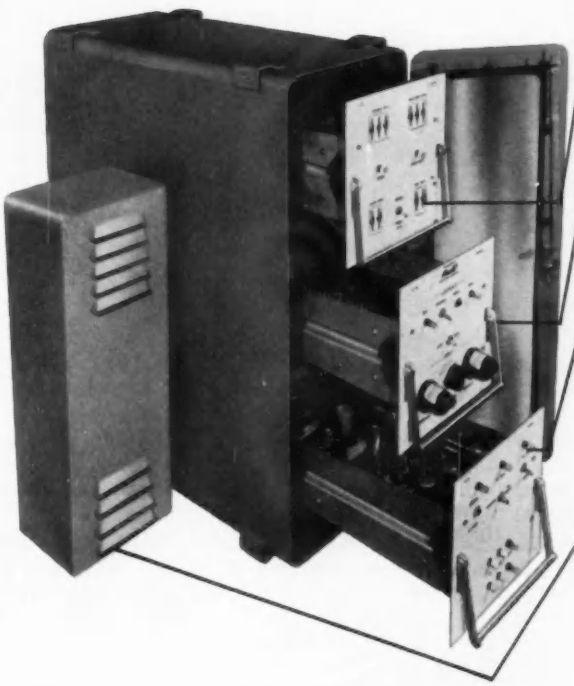
control certifies weld production costs

A resistance welding control that automatically compensates for every process variable



VOLTAGE CONSTRAINT

Graph shows how voltage control compensates for process variations. Any point on curved line E = IR represents a specific voltage. With normal weld as reference point, certain process variations cause increased resistance, while others cause a decrease. Control action is achieved through change of current to constrain voltage to same level for every weld.



SEQUENCE MODULE—Utilizes digital pulse-type circuitry . . . provides 100% accuracy.

HEAT CONTROL MODULE—Contains automatic and manual heat controls plus lockout devices. Processes input information from weld.

POWER SUPPLY MODULE—Power supply plus required auxiliary safety features.

FIRING MODULE—Provides large currents needed to fire ignitrons. Supplied as separate module.

for complete details contact: THE BUDD COMPANY • Electronic Controls Section • Philadelphia 32, Pa.

ELECTRONIC Budd CONTROLS

Circle 125 on Inquiry Card for more data

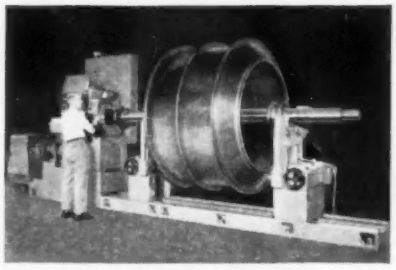
Would you take a parrot's word for it?

Why take anybody's word for it?

Static and dynamic balancing of rotating parts is a critical quality control process. The elimination of destructive vibration is "life insurance" for your product. It is worth doing *correctly*.

Test before you buy! When you buy a balancing machine, you'll want to outline your requirements specifically—and insist on comparative tests. Only then can you *know* what you're buying. No reliable supplier of balancing machines will refuse to cooperate in these tests!

Gisholt shows you. Gisholt invites you to see your work balanced on a Gisholt Balancer and to observe a series of scientific balancing tests—to prove that your tolerances and production requirements will be met, *before* you buy!



Gisholt 6U Balancer handles variety of rotors from 350 to 10,000 lbs. This 5600 lb., double-inlet wheel and shaft assembly is rotated at 150 r.p.m. and balanced within .0003" bearing displacement. Despite heavy workpieces and massive machine, no special foundation is required for accurate operation.

FREE BOOKLET. Because there are vast differences in balancing equipment, it is important to know how to compare competitive machines. Gisholt has released a new booklet, "Performance Tests for Balancing Machines." It explains basic facts about balancing, tells you how to analyze your requirements and outlines a series of performance tests to prove whether or not proposed equipment will meet your specifications.

Ask your Gisholt Representative for this new booklet or write for your free copy.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

Investigate Gisholt's Extended Payment and Leasing Plans

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Machines • *Factory-Rebuilt Machines with New-Machine Guarantee*

Circle 126 on Inquiry Card for more data

Circle 127 on Inquiry Card for more data

an education in itself—

"The gleam of Stainless Steel"

displayed at your favorite store

As one in the metals fabricating business—whether design, production or purchasing—you'll have a special interest in the stainless products for the home now featured at your leading store. The eye-opening promotion of variety, beauty and utility in stainless home products today is doubly impressive to the man who sees the technical accomplishments behind the glamor. • Many of the pieces will have been crafted from SUPERIOR Stainless Strip Steel—chosen for uniform highest quality in every coil. Specify it safely for your strictest demand.

Superior

STAINLESS STRIP STEEL

SUPERIOR STEEL DIVISION

OF

COPPERWELD STEEL COMPANY

CARNEGIE, PENNSYLVANIA

For Export: Copperweld Steel International Company, New York

Automotive engineers know the trade-mark

TIMKEN® MEANS SERVICE

Whether it's help with an assembly line problem, checking a new application design, reviewing laboratory or road test performance, or verifying a lubricant specification, your engineers know where to find the answers to their bearing questions. From a Timken bearing engineer.

This Timken Company technical partnership with automotive engineers is a tradition that dates back to the turn of the century. And it's been cemented and recemented every year since. When an automotive engineer calls a Timken bearing specialist, he gets immediate help—because he's talking with a graduate engineer, trained in the art of bearing application and experienced in automotive chassis design. And the Timken Company recommendations are backed by the most complete and advanced engineering, research and testing facilities in the bearing industry.

All this service costs you nothing extra. With the most modern bearing plant in the world, at Bucyrus, Ohio, Timken® "Green Light" automotive bearings are produced at low cost; deliver the high capacity with compact design that today's cars demand.

To be sure of top quality and value for your bearing dollar, plus service you can't get anywhere else, specify "Timken" instead of just a part number. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

TIMKEN "GREEN LIGHT" BEARINGS MEAN:

- **Lower Prices**
- **Lower Warranty Costs**
- **Lower Costs of Assembly**

BETTER-NESS rolls on

TIMKEN®

tapered roller bearings

Circle 128 on Inquiry Card for more data

Circle 129 on Inquiry Card for more data ➔

"SYSTEMATIC" PERFORMANCE . . . in a symphony orchestra every instrument complements the others in perfect harmony. That's the way a complete air brake system by Bendix-Westinghouse performs, too . . . all components are designed and engineered to work together. A complete Bendix-Westinghouse Air Brake System gives you systematic performance that delivers long-range economy, safety and dependability. That's the reason most of the country's leading fleet operators, and transport vehicle manufacturers, too, choose complete air brake systems by Bendix-Westinghouse. When it comes to new vehicles, make it Bendix-Westinghouse Air Brakes.

SPECIFY COMPLETE AIR BRAKE SYSTEMS BY *Bendix-Westinghouse*

BENDIX-WESTINGHOUSE AIR BRAKES

Whatever your operation—there's a dependable

BENDIX-WESTINGHOUSE COMPRESSOR for your job!

On city streets, over superhighways, along cross-country trails, everywhere motor transport is in use, you'll find Bendix-Westinghouse Tu-Flo compressors performing under the most rugged conditions . . . delivering an ample supply of air and maximum safety to trucks, trailers, buses and off-the-road vehicles.

Bendix-Westinghouse compressors are built to the most exacting standards and specifications. They've been laboratory-, road- and job-tested for billions of miles—efficiency-rated from the design board to final production tests—all with an eye to maintaining the highest quality ever built into a compressor.

Tu-Flo compressors feature lower discharge temperatures over the entire speed range, increased air delivery at low and intermediate speeds, improved oil control, efficient operation at higher maximum speeds to match trends in engine design.

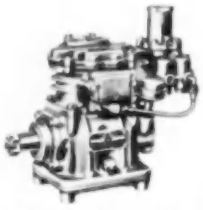
Write or call us today . . . or see your nearby Bendix-Westinghouse Authorized Distributor for more information about dependable Tu-Flo compressors.

Bendix-Westinghouse

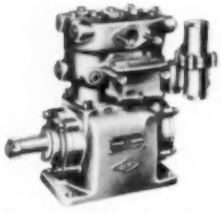
AUTOMOTIVE AIR BRAKE COMPANY

General offices and factory—Elyria, Ohio. Branches—Berkeley, Cal., and Oklahoma City, Okla.

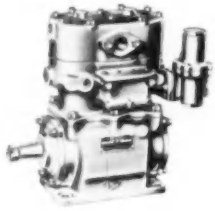
BENDIX-WESTINGHOUSE SINCE 1923 PACEMAKER IN TRANSPORT SAFETY



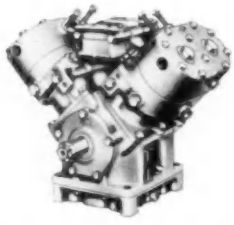
TU-FLO 300—Designed especially for lightweight trucks and school buses. Affords owners the comfort and safety of air brakes at low cost. Permits hauling air-equipped trailers.



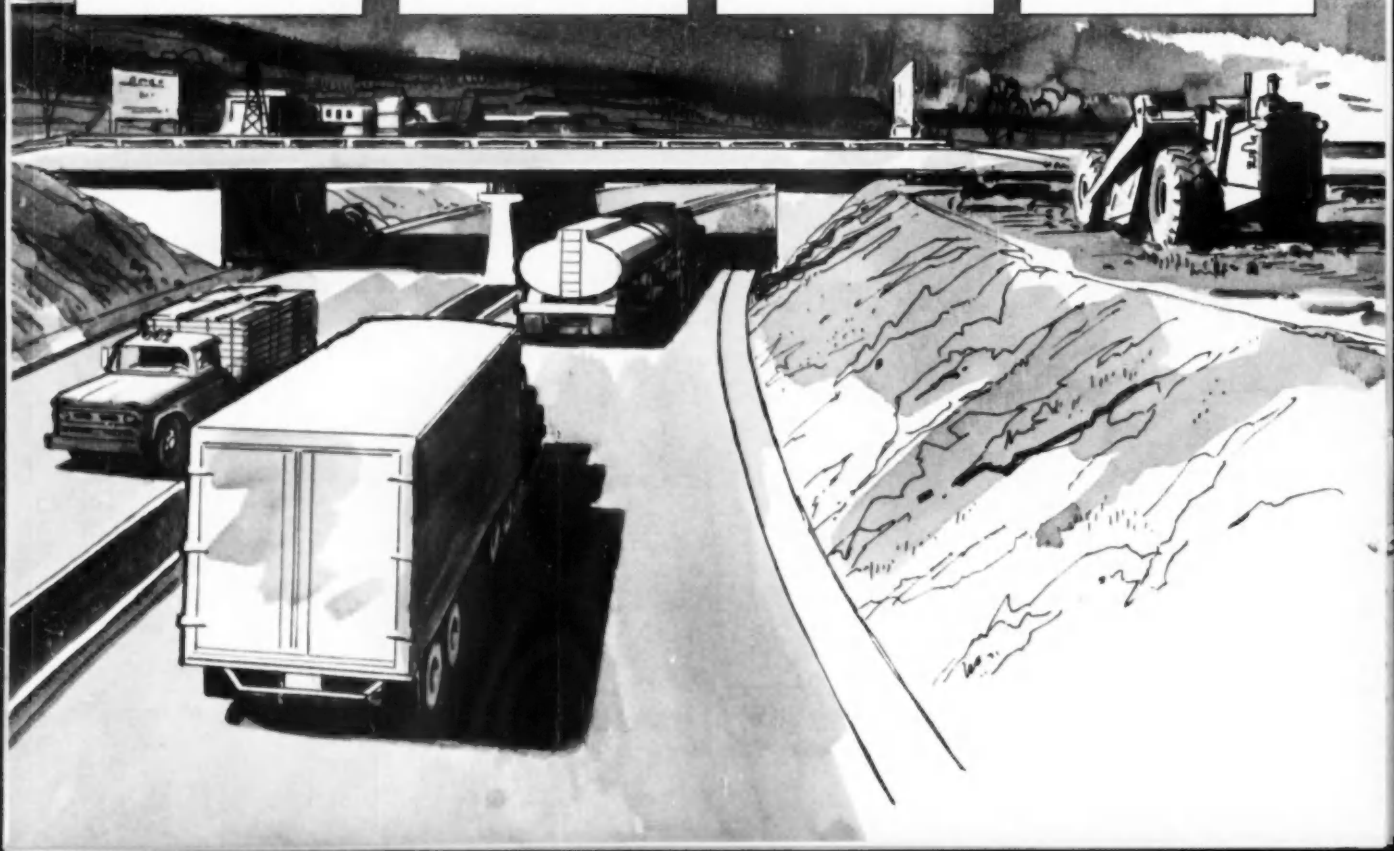
TU-FLO 400—This is the model that's most widely used by over-the-highway haulers. Available in either air- or water-cooled, self-lubricated or engine-lubricated types.



TU-FLO 500—For those operations where compressed air demand is heavy. Ideal for large city and interstate buses, off-the-road vehicles and other heavy-duty hauling operations.



TU-FLO 1000—A new high capacity compressor designed for air supply systems, stationary or mobile. Available in self-lubricated or engine-lubricated, air- or water-cooled models.



NEWS

Vol. 122, No. 4

February 15, 1960

Smaller Compacts Due

4-Cylinder Cars Seen Answer to Imports

Ford's newest compact, the Comet, will go on sale March 17, ushering in another "new era" in automobile history. Soon, four more cars are expected to join Comet in the newly-established medium-compact, or "luxury compact" field.

Thus only a few months after introduction of Falcon, Corvair and Valiant, another group of cars is joining the continuing small car revolution.

And, like Latin American revolutions, this small car revolution never seems to end. For, while the Big Three are rushing their medium-compacts to readiness, they also are laying preliminary plans for still another group of cars even smaller than the present compacts.

Shown in Capital

Comet made its first appearance at the convention of the National Automobile Dealers Association two weeks ago in Washington, and its first public showing at the Detroit Auto Show beginning Feb. 6. (For a detailed story on the new Comet see AI, Feb. 1.)

Ford has slipped the Comet in just above its hot-selling Falcon, with prices running about $80 above comparable Falcon models. The Comet carries suggested list prices of $1,998 for the two-door sedan; $2,053 for the four-door sedan; $2,310 for the two-door station wagon, and $2,365 for the four-door wagon. These prices include Federal excise taxes but do not include transportation or state and local taxes.

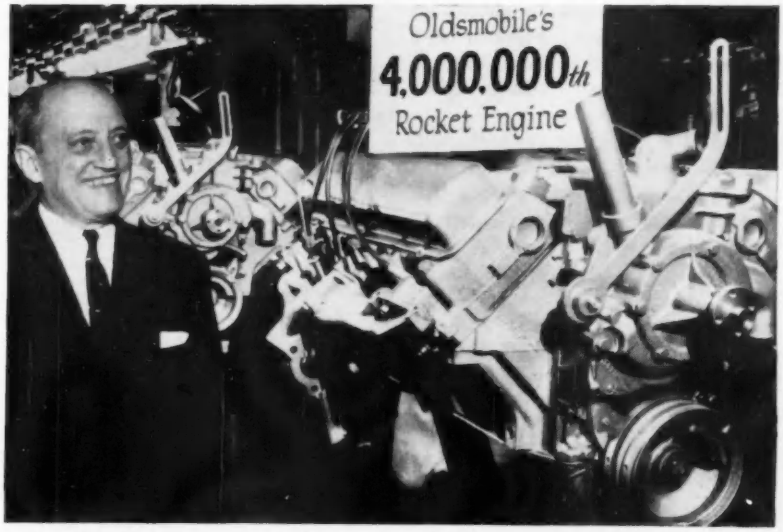
Real economy was promised by Ben D. Mills, general manager of the Lincoln-Mercury Div. Tests have proven, he said at the Washington preview, that Comet owners will get up to 28 miles per gallon on the open road.

Comet will be handled by approximately 1950 Mercury dealers when all franchising is completed. This set-up will give the bulk of Ford's medium-price dealers a chance to compete for the economy-minded customer.

Other Compacts Due

Buick, Oldsmobile, Pontiac and Dodge dealers will have medium-compacts of their own to offer,

FOUR MILLIONTH ROCKET ENGINE



An historical automotive milestone has been reached with production of the 4 millionth Oldsmobile rocket engine in Lansing, Mich. Pictured with the engine is J. F. Wolfram, general manager of Oldsmobile.

probably before the year is out. All four will be in the same general size and price category as Comet.

Detroit insiders incidentally, still are looking for permanent mold aluminum engine blocks in the Buick and Olds compacts, despite recent reports to the contrary.

Pontiac seems to be going its own way with a gray iron in-line four cylinder engine, which is basically one bank of the current Pontiac V-8.

Buick, which will build the engine for both divisions, is planning a total daily volume of 1000 engines.

Of course, there is no confirmation from either GM or Chrysler on the medium compacts, although Dodge's M. C. Patterson indicated recently, in a letter to dealers, that Dodge is studying the market and would be ready with the proper car if the market should warrant.

Patterson's words were reminiscent of the statements from Big Three executives when asked about compacts a year and a half ago.

Similar statements came from L. L. Colbert, Chrysler president, and J. O. Wright, Ford Div. general manager, when asked about the "small small" cars.

Imports Are Target

But, according to Detroit reports, the Big Three are going all out in their efforts to combat the imports. Ford's weapon in this battle reportedly is a 1650 lb front wheel drive car with an aluminum V-4 engine. One report says Chrysler's entry will be a 1600 lb four-passenger car with a rear-mounted engine.

Plans for these smaller cars, tentatively slated for 1962 introduction, could hinge on the success, or lack of success, of the current compacts.

Falcon is doing so well right now, for example, that Ford might decide that the little car will not be necessary to knock off the imports.

American Motors, currently selling everything it can build, is not sitting idly by. AMC has a new engine ready to go, and a major sheet metal change coming up for the 100 in. Rambler American. The regular Rambler is due for a major change for 1962.

Dodge January Sales Increase 110 Pct.

Here are some late sales reports from around the industry:

Dodge—January sales of 23,659 topped 1959's January retail deliveries by 110 per cent. Since introduction, 1960 model sales are up 85 per cent.

Rambler — Retail sales totaled 34,949 in January up 76 per cent from last January's 19,818. Since the model year began, deliveries of 127,889 cars represent an increase of 34 per cent.

Pontiac — January dealer deliveries of 30,254 new cars is a "substantial" boost over last year. Model year sales are up 12 per cent over the like period a year ago.

Metropolitan—January sales totaled 1111 units, up 23 per cent to make it the best January in history. Sales for calendar 1959 totaled 14,959, an increase of 18 per cent over the previous year.

Imperial — Deliveries of 18,897 units during 1959 made the year second only to the record 1957 and topped 1958 by 35.2 per cent.

Chrysler—January sales totaled 6285 as against 4965 last year. Total sales for the Chrysler and Imperial Div. for January were 7865.

Plymouth and Valiant—The daily sales rate in January was up 17 per cent over December. Plymouth sales totaled 22,839 a 64 per cent rise in per dealer sales over January, 1959, when Plymouth had more dealers. Valiant sales totaled 8146.

7 Dealer 'Sins' Listed by Speaker

Seven "capital sins" that ruin customer loyalty were enumerated to delegates attending the 43d annual convention of the National Automobile Dealers Association in Washington.

Frank P. Tighe, editor of *Motor Age*, listed these "sins" as expedience, failure to keep promises, unskilled diplomacy, the customer's-always-wrong-attitude, oral misrepresentation, uncleanliness and failure to appreciate the business the customer brings into the shop.

Tighe urged the dealers to keep their service departments clean and well-equipped and assured them they would thus benefit financially.

Canadian Output Of Trucks Up 10 Pct.

Canadian production of commercial vehicles in 1959 gained about 10 per cent over the postwar low to which the truck business sagged in 1958.

When 1959 registration figures are in, showing all commercial vehicle sales, the total is expected to be about 80,000 units worth more than $300 million.

In 1958, sales were 68,046, with a retail value of $254,742,000.

BRITISH BUILD STATION WAGON FOR CANADA

The Vauxhall Sherwood Envoy station wagon features squared-up frontal treatment and large tail lights. It is based on the four-cyl Victor. Built in England, this model is made especially for Canadian patrons.

Ford Profits Rise To $8.24 a Share

Ford Motor Co. posted sales of $5.357 billion and net income of $451.4 million in 1959. This amounts to $8.24 a share compared with $2.12 last year, making 1959 the second best in the company's history.

Not bad for a company that (A) discontinued a car line (Edsel) that was a dismal and expensive failure; (B) tooled, produced and introduced a complete new car line (Falcon); and engineered, tooled and prepared a second new car (Comet).

Ford's sales were 30 per cent higher than 1958 sales of $4.13 billion, and earnings were nearly quadruple the previous year's income of $116 million. The new marks were posted on factory unit sales of 2,091,106 cars and trucks during the year, up from 1,466,802 the year before.

During the year, Ford increased its working capital from $570.5 million to $829.2 million.

Tooling costs, always a secret, were heavy during the last year. Ford remembered its untimely and unfortunate experience with Edsel, but nevertheless invested heavily in both Falcon and Comet, although the latter is in reality a rework of the Falcon. Capital expenditures amounted to $75 million during 1959, a drop of $14 million.

Milsco Occupying Addition to Plant

Milsco Manufacturing Co. is occupying an addition to its plant at 2758 N. 33rd St., Milwaukee.

Originators of contour seating for farm tractors, Milsco has expanded its engineering and research departments with opening of the addition.

Milsco was organized in 1924 by its president, Carl T. Swenson. It has designed and produced seating and accessories for motorcycles, trucks, tractors and road machinery.

GM Sales, Earnings 2d Highest in History

General Motors had the second highest sales and earnings in its history in 1959 despite shut downs in the fourth quarter because of the steel strike.

John Gordon, president and Frederic G. Donner, board chairman, in their preliminary report, estimated last year's sales at $11.2 billion, an 18 per cent increase over 1958 sales of $9.5 billion. Profits increased to $3.06 a share against $2.22 in 1958.

Fourth quarter earnings were indicated at 51 cents a share, against 83 cents in the final three months of 1958.

GM's best year was 1955, when sales totaled $12.4 billion.

4-Day Strike Idles 18,000 at Chevrolet

Some 18,000 Chevrolet workers in Flint, Mich., and St. Louis were idled by a four-day strike that began Feb. 3 in a Chevrolet Flint parts plant. The dispute involved 19 jobs in the crankshaft grinding department.

UAW Local 659 charged a speedup, while Chevrolet said work standards had been set after job changes were made. No settlement details were revealed.

Autolite Establishes Equipment Sales Dept.

Electric Autolite Co. has set up a centralized equipment sales department to coordinate all automotive OEM sales.

Edward R. Stroh, director of sales, says OEM customers will be able to do multi-product business through a single account executive and all Autolite information will channel through that one individual.

FOUR-WHEEL DRIVE AUTO UNION 'BRONCO'

This all-purpose vehicle is answer to rough country transport problems. It has eight forward and two reverse speeds. It can carry a full load up a 50-degree grade or pull an 1,100 lb trailer up a 30-degree grade.

NEWS

CONTINUED

Ford to Build Plants In England, Rhodesia

Ford Motor Co. is planning to build two overseas assembly plants through its affiliated companies in England and Canada.

In England, a $70 million plant is planned for Halewood, near Liverpool, with productive capacity up to 200,000 vehicles a year. The English Ford company, which last year turned out 469,000 units, would employ 8,000 persons at the new plant.

And in Rhodesia, a $3.5 million plant is going up to serve the Federation of Rhodesia and Nyasaland. This plant will be built by Ford of Canada, which currently ships built-up vehicles into the federation.

The new plant at Salisbury will turn out seven vehicles from Ford-England, plus the Falcon, F-100 pick-up, German Ford's Taunus cars and Dexta tractors from England.

Ford of Canada has been operating an assembly plant in the Union of South Africa since 1923 and now has dealers in 41 countries outside Canada.

N. Y. Dealer to Sell Russian Sedan

Robert Castle, Herkimer, N. Y., auto dealer, has announced plans to market the Russian-made Moskvich sedan in the United States. Castle said he has contracted with the Soviet Union to buy 10,000 cars. The first shipment of 5000 is due in the U. S. this summer and the rest will be delivered within two years.

The Moskvich is the Russian economy car and sells there for the equivalent of $2,500. Castle said he expects to sell the car here for less than $2000. In Washington, government officials said the Russians probably will make price sacrifices in an effort to "crack" the U. S. auto market.

UNDERCARRIAGE RETRACTS HYDRAULICALLY

Capable of carrying 60 passengers, this Czechoslovakian semi-trailer bus has bodywork adapted from standard Skoda coach. Front undercarriage retracts hydraulically after coupling. Trailer is linked to cab by intercom system. Skoda tractor is powered by 718-cu in. six-cylinder Diesel developing 170 hp.

Davidson to Close Charlestown Plant

Davidson Rubber Co. is discontinuing operations at its Charlestown, Mass., plant effective March 31. The company will drop its molded, solid and chemically blown sponge rubber product lines.

Closing of its Charlestown plant will allow Davidson to devote full resources to its rapidly expanding lines of molded polyurethane foam products now being produced at its Dover, N. H., factory. The company's general offices will be moved to Dover.

Undercoating Group Selects Officers

The Automotive Undercoating Manufacturers Association selected officers at their annual meeting in Detroit.

They are D. W. Maher, Minnesota Mining and Mfg. Co., president; G. R. Widger, Tuff-Kote Asphalt Products, Inc., vice president; M. Jelin, Lewis Asphalt Engineering Corp., secretary, and H. E. Hutson, H. Gibson - Homans Co., treasurer.

French '59 Output Sets All-Time Record

The French Motor Manufacturers Association reported the 1959 output of 1,283,159 vehicles was an all-time record. The previous mark, set in 1958, was 1,127,549.

Of the total, 1,085,177 were passenger cars. This compared with 938,606 cars in 1958.

While the export total is not yet known, the manufacturers estimated this figure would be about 600,000.

Parts, Service Dept. Divided by AMC

With increased Rambler sales, American Motors Corp. has divided its Parts and Service Dept. into two separate departments.

C. M. Tillinghast becomes general service manager with responsibility for all technical service, service promotion and training activities.

Technical Report

Piston ring progress...

When your heart is in what you do, you think about it quite a bit.

We at Perfect Circle think constantly about piston rings...better piston rings...better ways to make piston rings.

Now we make another step forward—a major step that comes from looking at piston rings in their functional relationship to the whole engine assembly.

The pursuit of efficiency and compact engine design creates a demand for space and weight saving. Pistons eventually must be made shorter and lighter —provided shorter pistons can be sealed effectively. Shorter pistons will allow shorter cylinders and blocks, with saving in space and weight. How can we seal shortened pistons? Combining the conventional intermediate compression ring and the oil ring appeared to be a logical solution...we are now confident that it is.

After an intensive program of dynamometer and field testing we are now presenting the initial design of our ring.

This is what our new type piston ring will do:

Save space. Reduce overall piston height up to ¼", saving same height in engine block. Reduce total engine weight. Lower reciprocating weight.

Control oil and seal compression as well as or better than current piston ring complements.

Reduce ring friction up to ten percent. Reduce wear area in cylinder.

Operate carbon-free even in heavy-duty use.

Perfect Circle's new weight-saving, space-saving, "101" oil and compression ring.

When you are confronted with problems involving piston rings or related engine components, we would appreciate the opportunity to work with you in research and engineering. Perfect Circle Corporation, Hagerstown, Indiana; The Perfect Circle Co., Ltd., Don Mills, Ontario, Canada.

PERFECT CIRCLE

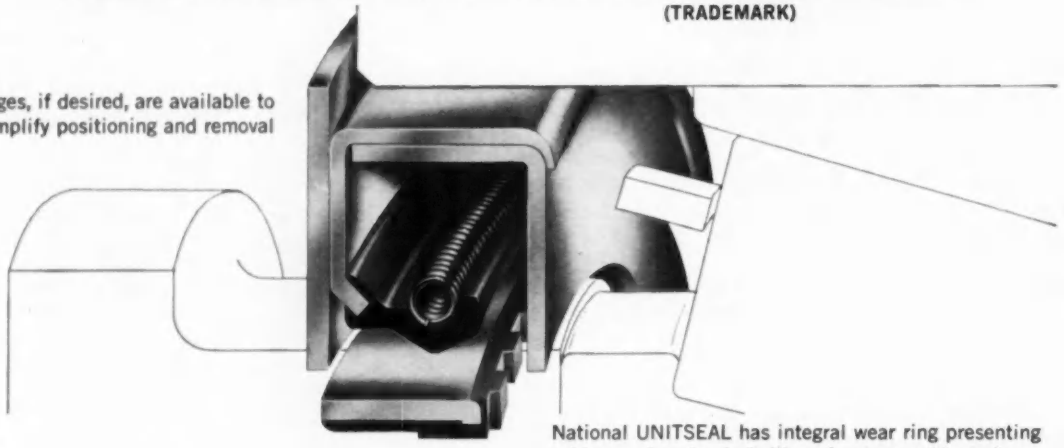
Circle 130 on Inquiry Card for more data

NATIONAL® OIL SEAL LOGBOOK

Announcing!

NATIONAL UNITSEAL
(TRADEMARK)

Flanges, if desired, are available to simplify positioning and removal



National UNITSEAL has integral wear ring presenting rubber surface to shaft. Wear ring turns with shaft, sealing lip is never exposed to damage, cannot score shaft.

A new unitized oil-seal-and-wear ring that eliminates:

SHAFT WEAR OR SCORING

SEPARATE METAL WEAR SLEEVES

EXPENSIVE SHAFT FINISHES

COSTLY SHAFT RE-MACHINING

SEALING LIP INSTALLATION DAMAGE

SPECIAL INSTALLATION PROCEDURES

New National UNITSEAL is now in production, in a limited range of sizes, for heavy oil and grease sealing applications — including truck, bus and tractor uses. Still newer UNITSEALS are on the way for higher speed automotive and similar uses.

Changing a National UNITSEAL automatically changes the wear sleeve — in one fast operation. Since the seal has its own integral wear ring, it is almost impossible to install it other than squarely on the shaft. Expensive shaft finishing is no longer a necessity, nor is leakage under a metal wear ring a problem—both thanks to the rubber surface UNITSEAL presents to the shaft.

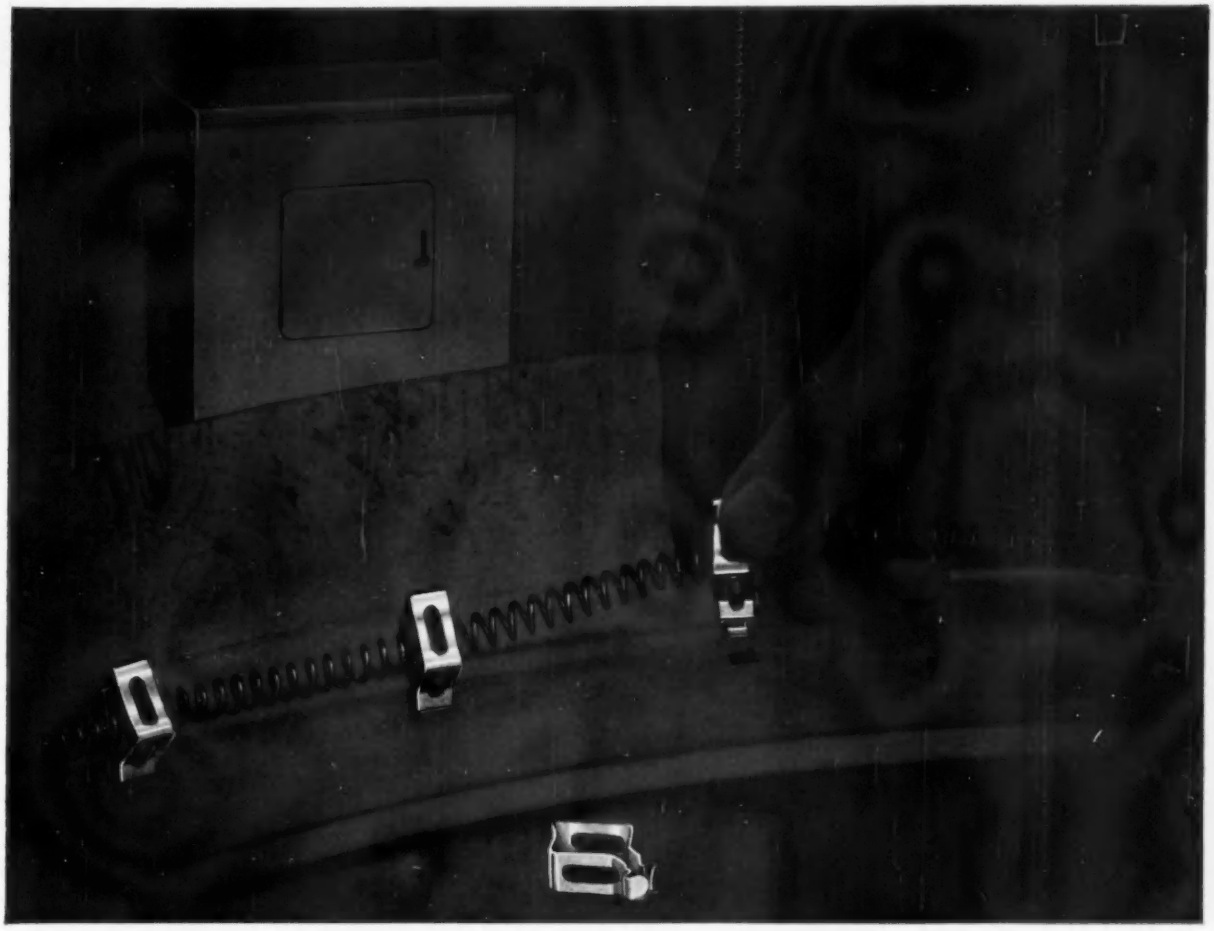
Get complete details today; write direct, or call your National Seal Applications Engineer. He's in the Yellow Pages, under Oil Seals.

NATIONAL SEAL

Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California
Plants: Van Wert, Ohio, Redwood City and Downey, California

6013

Circle 131 on Inquiry Card for more data



Engineered by Tinnerman . . .

SPEED CLIPS® reduce costs, simplify assembly and servicing on Maytag "Halo of Heat" Dryer

Clothes are dried efficiently in the famous Maytag "Halo of Heat" automatic dryer. And now the quality of the "Halo of Heat" dryer is even better than ever because its unique circular heating element is fastened quickly, securely by 22 special Tinnerman SPEED CLIPS developed by joint efforts of Tinnerman and Maytag designers.

Each one-piece SPEED CLIP eliminates a separate welding operation on the "Halo of Heat" assembly. Various screw-driving operations formerly required on Maytag's assembly line to capture the ceramic insulator and secure the mounting clamp were also eliminated, with equally interesting reductions in cost. Now, the stainless steel, vibration-proof fastener is snapped in place with simple "button-hook" action. No special skills or equipment are required. Assembly and parts costs have been reduced . . . *substantially!* Serviceability in the field has been improved.

A free Tinnerman Fastening Analysis of your own product can show you where similar assembly and cost-saving advantages are possible. Call your Tinnerman representative—he's listed in the Yellow Pages under "Fasteners". Or write to:

TINNERMAN PRODUCTS, INC.
Dept. 12 • P. O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
Speed Nuts®

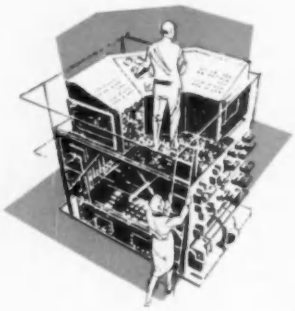
FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S. A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano-Bundy GmbH, Heidelberg.

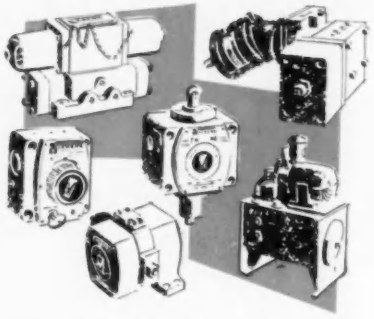
Circle 132 on Inquiry Card for more data

BONUS FEATURES LIKE THESE BOOST YOUR PRODUCT PERFORMANCE

Advanced Design—More than 800 engineers and technicians plus unequalled research and development facilities devoted to every phase of hydraulics assure that Vickers will continue to provide the finest in products and systems.

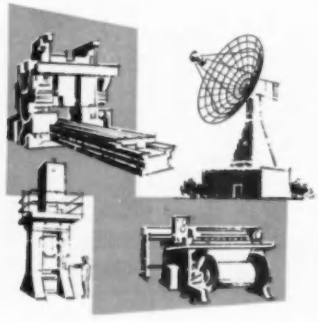


Unified Systems Responsibility—When the job calls for a more complex installation, you don't have to develop your own system by "shopping around". Vickers provides custom engineered, ready-to-go systems that invariably save you money in the long run.

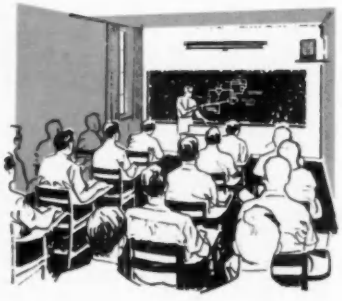


Most Complete Line—Because Vickers designs and builds the broadest line of top quality hydraulic components available anywhere you are assured of getting just what your installation requires. You don't have to compromise performance in any way.

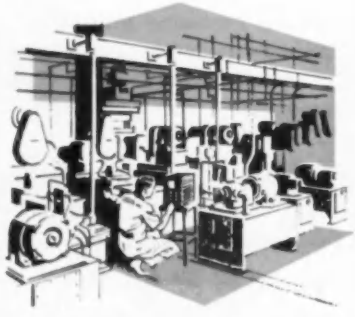
"Single Line" Application Engineering—You can rely on top quality field assistance in planning any hydraulic installation because your Vickers sales engineer is just that—a highly qualified engineer with responsibility for a single manufacturer's product line.



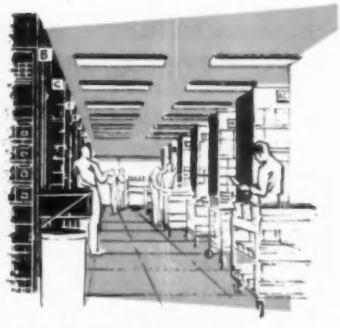
Hydraulic Experience without Equal—Nearly 40 years of experience in developing and building hydraulic equipment that has won a worldwide reputation for being advanced in design and reliable in performance stands behind every Vickers unit or system.



Customer Training—Your engineers, technicians and maintenance men benefit from attendance at Vickers' hydraulic school or Vickers-sponsored hydraulic conferences. These activities plus technical publications help keep industry posted on the newest fluid power ideas.



Unmatched Field Service—No matter where your equipment goes to work a skilled Vickers service man is close at hand to insure that it always performs as specified. Because he's responsible for a single manufacturer's product line, he's up-to-date on latest designs and techniques.



Regional Repair and Parts Stocking—Not only do Vickers units outperform and outlast ordinary designs but you have less downtime for maintenance too. When service is needed, regional service centers provide units tested to factory specifications assuring peak operating efficiency.

International Manufacturing Sales and Service—No matter where Vickers parts are made throughout the free world, they are completely interchangeable. Thus, you gain added freedom in design and manufacture of your product, particularly if it is intended for export sale.

Machine builders and users choose VICKERS® hydraulic pumps and valves by wide margin

"Machinery Magazine" study shows Vickers leads next brand by 4.4 to 1 in pumps, 6.4 to 1 in valves

Once again users and builders of machinery have shown an overwhelming preference for the quality and performance of Vickers hydraulic pumps and valves. In the recently completed "Machinery Magazine Brand Preference Study" Vickers pumps and valves not only attained considerably higher weighted scores than the runners up but enjoyed even wider margins in the "first choice" categories (see tabulation below).

Close cooperation with its customers—large and small—has characterized Vickers operations over the years and is reflected in this "vote of confidence" from the field. The end result is that buyers of machinery have come to accept Vickers-equipped machines as offering something extra in reliability and productivity.

When you specify Vickers hydraulic components, you get the finest hydraulic equipment of the most advanced design and more besides. Some of these extras are described briefly on the facing page. For more details on any of these or the complete line of hydraulic components or systems contact your nearby Vickers application engineer or write for the new Vickers catalog 5001.

HYDRAULIC PUMPS

	First Choice	Second Choice	Third Choice	Weighted Total %
Vickers	186	56	14	49.2
Company B	31	29	5	11.2
Company C	25	23	12	9.6
Company D	20	26	11	8.9

22 other companies accounted for the remaining 21.1% of the weighted total.

HYDRAULIC VALVES

	First Choice	Second Choice	Third Choice	Weighted Total %
Vickers	147	32	7	47.1
Company B	18	9	9	7.4
Company C	13	16	—	6.5
Company D	8	14	5	5.2

24 other companies accounted for the remaining 33.8% of the weighted total.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

Machinery Hydraulics Division

ADMINISTRATIVE and ENGINEERING CENTER

Department 1428 • Detroit 32, Michigan

8496

Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON INDIANAPOLIS • LOS ANGELES AREA (El Segundo) • MILWAUKEE • NEW YORK AREA (Springfield, N.J.) • PHILADELPHIA AREA (Media) PITTSBURGH AREA (Mt. Lebanon) • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • WORCESTER
Factories also in: Australia, England, Japan and Germany • In Canada: Vickers-Sperry of Canada, Ltd., Toronto, Montreal and Vancouver

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

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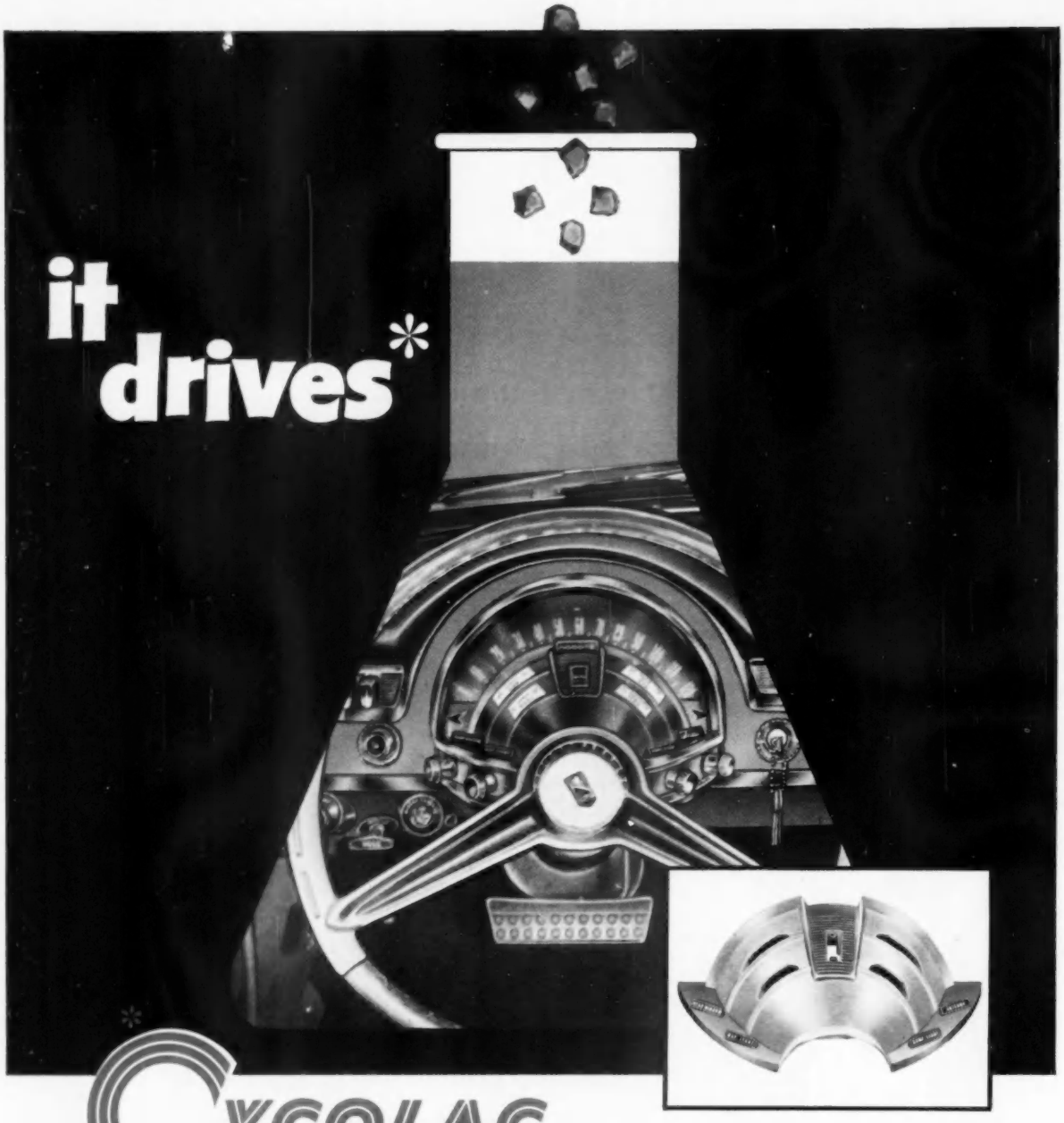

CYCOLAC®

THE BORG-WARNER PLASTIC THAT'S TOUGH, HARD, AND RIGID

Every year, the auto industry finds new applications for CYCOLAC—to the tune of important savings and an improved appearance for many products. The 1960 Chrysler instrument panel you see above is a typical example.

This unique panel, molded of Borg-Warner CYCOLAC, cuts production costs because it replaces expensive die-cast metal with economical molded plastic. It also replaces chrome plating with vacuum plating . . . another cost-economy. Product-appearance is improved because the toughness, hardness and rigidity of CYCOLAC enable it to keep its "like new" look for many years.

CYCOLAC *Better in more ways than any other plastic*

GET THE FACTS—WRITE TODAY!

MARBON CHEMICAL WASHINGTON — DIVISION **BORG-WARNER** WEST VIRGINIA

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NEWS

FEATURES

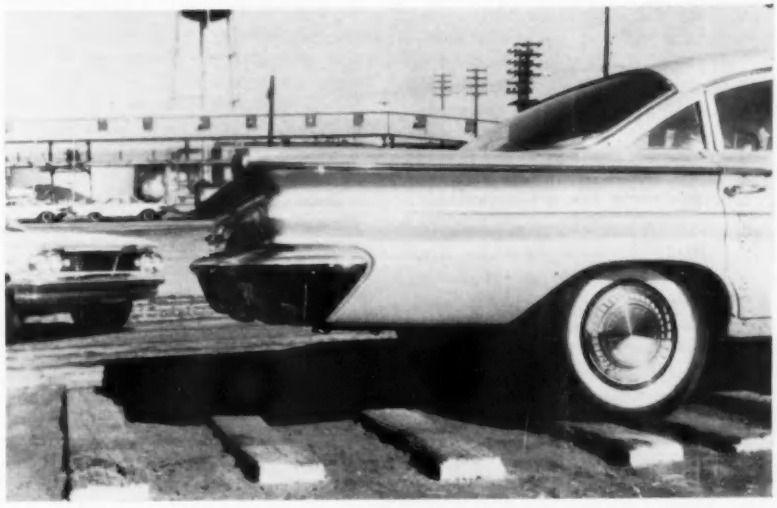
Smog Battle Solution Reported Nearing

A practical solution to the smog problem is close at hand, Dr. Dean E. Wooldridge, president, Thompson Ramo Wooldridge, Inc., has told a California Senate group investigating the Los Angeles smog.

Dr. Wooldridge said his firm and Chrysler Corp. are developing a device capable of reducing gases in the exhaust stream so low that the Los Angeles area can sustain more than twice as many automobiles with much less than the present smog irritants.

Dr. Wooldridge told the Senate group decisions are needed on inspection procedures and whether recently adopted standards should be stiffened.

QUALITY CONTROL AT PONTIAC



All new Pontiacs are driven over railroad ties at the Pontiac, Mich., testing grounds to check steering mechanism and to eliminate body rattles.

60 lb of Aluminum Used in Valiant

Chrysler reports it is using 60 lb of aluminum in its compact Valiant, including 18.94 lb in the engine and 33.96 lb in the automatic transmission. Jack E. Charipar, chief engineer and director of product for the Plymouth-De Soto-Valiant Div., said use of aluminum saves about 102 lb or 4 per cent of Valiant's shipping weight.

Heaviest individual parts made of aluminum in Chrysler's Valiant include the intake manifold, clutch housing, automatic transmission case, transmission extensions, grille and alternator housing.

Thompson Working On New Turbocharger

Thompson Products, the automotive division of Thompson Ramo Wooldridge, is developing a low-cost turbocharger for gasoline engines. It is claimed to increase output by 30 per cent while using less fuel.

Another item is a thermostatically-controlled fan which also is speed-limiting. It is intended primarily for vehicles equipped with air conditioning.

T-P also has some developments on the fire that are not yet ready for production. One of these is a fuel injection system for passenger car engines. It is claimed to be fully acceptable from an operating standpoint and moderately priced. The unit has been demonstrated to one of the large producers.

A small but important item is an automatic transmission shaft seal made of teflon. Its design is such as to make replacement simpler and less costly.

An electro-hydraulic brake system for trailers drawn by passenger cars has been tested and will be available initially for boat trailers. It employs hydraulic brakes fitted with a motor drive at each wheel for initiating braking action.

Plant Addition

Dominion Rubber Co. is erecting an addition to its plant in Guelph, Ont.

AI TABLOID

J. D. D'Ianni, a research executive, recently told the American Chemical Society that it is becoming increasingly difficult to classify a new polymer as a rubber or a plastic. "It becomes more easy to fit a specific polymer to a specific end use, than to decide its classification," D'Ianni declared.

* * *

American producers of farm machinery and equipment have a good potential market in South America, the U. S. Department of Commerce reports. A survey discloses that European competition is stiffening but that U. S.-made equipment long has been favored by South American farmers and ranchers.

* * *

Allied Chemical plans to triple its annual production of Golden Caprolan nylon-6 yarn for automobile tires. Long-distance turnpike driving has increased the demand for safer high-performance tires, according to Allied executives.

* * *

British Motor Corp., Britain's largest motor manufacturer, exported 30 per cent more vehicles last year than in 1958. Hambro Automotive Corp., BMC's U. S. representative, reports 259,011 vehicles were exported world-wide. Of this number, 104,304 came to North America.

* * *

General Tire & Rubber Co. has opened an 8½ mile oval tire testing track at Uvalde, Tex. The track is being used to test automobile tires at speeds up to 200 mph. Truck and bus tires are tested on an inner lane at slower speeds.

* * *

United States consumption of new rubber amounted to 125,922 long tons in November, 1959. This compares with 147,643 tons in October, 1959, and 122,754 tons in November, 1958. Production of all types of synthetic rubber totaled 124,825 long tons in November, 1959, compared with 128,532 tons in the previous month and 102,496 tons in November, 1958.

A bibliography of 290 technical references in the field of gas lubricated bearings has been prepared by the Franklin Institute Laboratories. It is for sale to the public by the Office of Technical Services, Business and Defense Services Administration, U. S. Department of Commerce.

* * *

The 1,500,000 cu ft of helium in each of three huge airships built for the airborne early warning system provides a lifting power of more than 90,000 lb. The 400-ft blimps carry the largest radar and electronic system to be installed in a single aircraft.

* * *

New chemicals that prevent scale formation on metals during heat treatment are available to industry, it has been announced by Navan Products, Inc., North American Aviation's invention marketing subsidiary. Invention of the new chemicals was recently announced by North American.

* * *

Shipments of complete civilian aircraft amounted to 2,048,700 lb in November, 1959, according to the Federal Aviation Agency. During November, 705 planes valued at $77 million were shipped.

* * *

Because of a temporary shortage of heavy duty trucks in the United States during the steel strike, import authorizations were granted in December for 177 such vehicles classed as foreign excess property. Foreign excess property is property sold abroad by the U. S. Government and ordinarily is approved for import only to ease shortages or otherwise to be beneficial to the country's economy.

* * *

Thirteen-inch tires for the new American compact cars are vastly different from those of that size produced in the United States since 1955 for imported autos. The American-car tires were designed and engineered specifically for the weight and suspension systems of the U. S. cars, which vary considerably in that regard from their foreign counterparts.

Automotive Div. Set Up by S-P

Studebaker-Packard Corp., feeling the growing pains of a company making money, has isolated all automotive activities in a new Automotive Div. A. J. Porta, 35-year Studebaker veteran, has been named general manager of the new division.

S-P, which made a profit in 1959 for the first time in the company's rocky five-year history, anticipates further growth in the automotive field. The new division should make this easier by co-ordinating all domestic production, Canadian export operations, and the Mercedes-Benz Sales Corp. and Auto-Union distribution in this country.

But the new division also paves the way for further diversification by setting the automobile operation apart from plastic and other non-related activities.

5 Auto Heads Named To ASTME Committee

The American Society of Tool and Manufacturing Engineers (ASTME) has named five Detroiters to an honorary host committee for the society's 28th annual conference April 21-28.

Named were L. L. Colbert, president, Chrysler Corp.; John F. Gordon, president, General Motors; George Romney, president, American Motors; Henry Ford II, president, Ford Motor Co.; and Malcolm P. Ferguson, president, Bendix Aviation Corp.

Hill is Elected

Philip S. Hill, executive vice president of the Hyster Co., has been elected president of the Industrial Truck Assoc. Roy L. Wolter, general manager of Automatic Transportation Co., Chicago, was elected vice president.

Missile Air Cushions Ordered by Martin

An order for 96 air cushions, used by the Air Force as "shock absorbers" in recovering its TM-76 Mace tactical missile during training and test flights, has been received by the Goodyear Tire & Rubber Co.

Made of neoprene-coated nylon fabric, the cushions, which Goodyear calls "recovery bags," are shaped like giant sausages and fit snugly around the middle of the missile when popped into shape by compressed air.

The oddly-shaped bags, purchased by The Martin Co.'s Baltimore Div., designer of the Mace, are one phase of a recovery system used in returning the missile to the ground without damage.

Without recovery bags, the Mace would be a one-shot weapon which would plunge earthward to destruction at the end of its flight.

Ability to recover the missile means that troops can be given more intensive training in the launching sequence, with the cost significantly lower. In addition, when the Mace is used as a test vehicle for expensive guidance systems and there is a malfunction, it can be brought back for examination. When used as a target drone for other missiles, the Mace can be recovered if no hits are scored.

Westinghouse Supplies Wind Tunnel Units

Drive equipment valued at $200,000 is being supplied by Westinghouse Electric Corp. to power new compressors for the "blow-down" wind tunnel at Lockheed's California Div. Research Center.

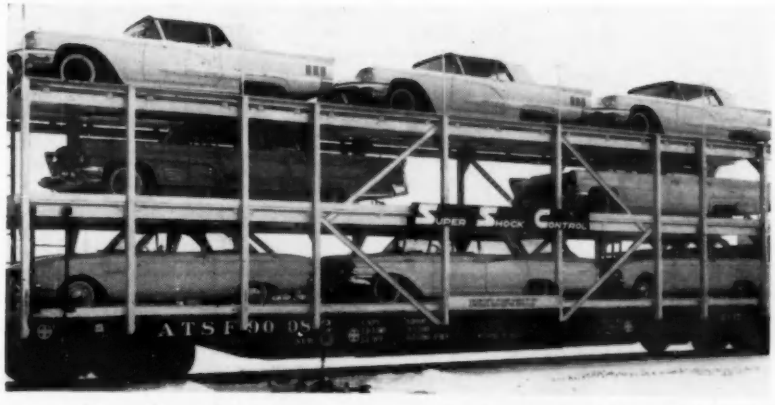
Components of the system will include a 7000 hp synchronous motor, a 7800 hp gear unit, switchgear and control.

Vigilant Fighters Ordered by Navy

A $73 million Navy contract for additional carrier-based A3J-1 Vigilant jet fighters has been awarded to North American Aviation, Inc.

The Vigilant is an all-weather jet fighter. It is the Navy's first aircraft in which all systems and system components are supplied by the manufacturer.

TRIPLE DECK FORD RAIL SHIPMENT



Ford Motor Co. and the Santa Fe Railway are experimenting with this trilevel flat car shipment of autos from Ford's Wixom, Mich., plant to Los Angeles. Santa Fe plans 88-ft cars capable of carrying up to 15 automobiles.

Aerojet Establishes New Materials Div.

Aerojet-General Corp. has established a new Structural Materials Div. to meet the increased need in the missile field for fuller exploitation of metallic and non-metallic materials and processes.

The Structural Materials Div. is a combination of the Structural Plastics Div. and the Materials Department of Azusa Operations staff.

Thiokol to Produce Minuteman Engine

Thiokol Chemical Corp. has been designated first stage engine contractor for the Minuteman ICBM and has been given second stage engine production backup responsibility.

"Subject to successful test demonstrations, Aerojet General Corp. will undertake production of the second stage propulsion unit," the Air Force said.

RCA Gets Contract For Missile Tracking

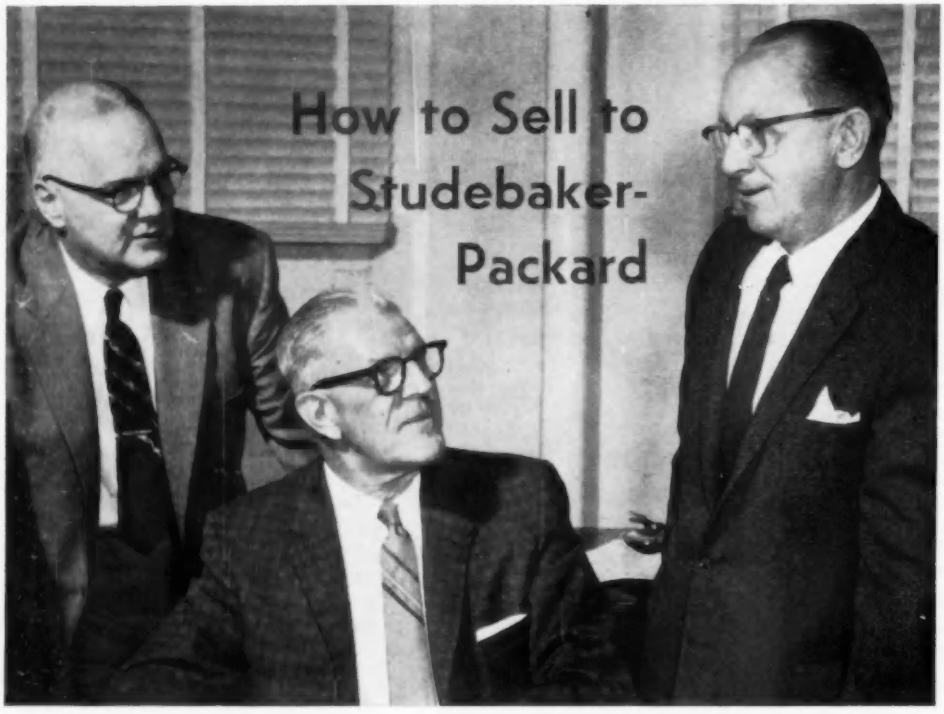
An $8,911,904 contract for installation of new equipment to improve missile tracking of the American Mariner, operating on the Atlantic Missile Range, has been awarded to the Radio Corp. of America.

The contract provides for installation of new radar equipment and continued technical operation of the ship in the South Atlantic.

Cessna's '59 Sales

Cessna Aircraft Co. has announced sales of 3564 units during 1959. This is 50.6 per cent of the light plane market, Cessna officials claim.

How to Sell to Studebaker-Packard



Studebaker - Packard purchasing problems are discussed by John Soelch (seated), Director of Purchasing, and his assistants, C. M. Brown (left) and E. C. Woltman.

By John Soelch
Director of Purchasing

Three basic principles guide Studebaker-Packard Corp. purchases. These are a competitive price, consistent quality and delivery as scheduled.

A competitive price for parts from our suppliers is necessary in order that our own final product be priced competitively.

Quality is of obvious importance in maintaining our century-old tradition of Studebaker craftsmanship. Quality must include the characteristics of functional performance, good material content, reliability and durability. All parts must fully and consistently meet engineering specifications.

We expect shipments from our suppliers to arrive on schedule. This is required to assure the steady operation of our assembly lines.

All of these considerations are equally important. Securing supplies at lower prices offers us no advantages if quality is impaired or if we have to make costly inquiries or take other action to expedite delivery.

Creation of a new model begins in our Styling Department with design and continues in our Engineering Department for manufacturing feasibility of design and prototype development.

The Purchasing Department then receives specifications for parts and we call in our suppliers.

In the case of a new supplier, we must be assured of a good past business record, financial stability and capacity to produce to meet our requirements. In some cases the location of a supplier in relation to South Bend is a factor.

We expect to take advantage of the engineering, research and technical talent of our suppliers to improve our product. New ideas are presented to our engineers who are ready to cooperate with suppliers in working out improvements and practical applications.

Studebaker has enjoyed an excellent supplier relationship. The loyalty and trust of many of our suppliers during former adverse business conditions is especially appreciated by the corporation.

Typical of rugged Studebaker-Packard products is this Transtar truck. One and 1½-ton models have gross weights from 9,000 to 18,000 lb.

Anti-Skid Brakes Called Jets' Need

The performance and design of the latest jet aircraft has drastically increased the need for automatic braking control and anti-skid devices, according to Douglas Nickerson, chief engineer for Hydro-Aire Co.

In a speech to the Washington section of the Society of Automotive Engineers, Nickerson said that in addition to the great rise in aircraft landing speeds, reduced drag and elimination of the reversible prop in jet designs have accentuated the braking problem.

To avoid skids and offer maximum braking, automatic systems that detect slip in any wheel and relay corrective signals to control devices are required for all the latest jets, Nickerson declared.

By controlling braking so that the wheels are rolling at all times —rather than slipping as in a skid —an aircraft's tires gain maximum ground friction and the aircraft maintains good directional stability.

250 MPH Speeds For 'Copters Predicted

Helicopter speeds of nearly 250 mph and payloads up to 50 tons were forecast by Philip L. Michel, chief of advanced research, Sikorsky Aircraft Div., United Aircraft Corp., at the annual meeting of the Institute of Aeronautical Sciences.

Mr. Michel said such performances are within the helicopter industry's capabilities. Their achievement, he added, will require greatly expanded research supported by both private industry and the military services.

"Research indicates the helicopter can be designed to achieve speeds from 200 to 230 mph by various means," Mr. Michel declared. "These include greatly increasing negative blade twist to delay blade stall on the helicopter's retreating blade; increasing rotor solidity by adding more blades; and using such auxiliary forward propulsion as turbine engines with conventional airplane propellers."

JET PASSENGERS PROTECTED FROM WEATHER

United Air Lines is installing 19 Jetways corridors at San Francisco and New York airports to keep customers warm and dry in bad weather. The Jetways, which extend to 107 ft, connect planes with second story of terminal buildings.

Hiller Announces 'Copter That 'Grows'

Hiller Aircraft Corp. has announced kits are available which allow civilian owners of 12E helicopters to add horsepower, multiply the craft's hovering capacity by 3½ times and increase the size of the cabin.

An engine carburetor kit, Hiller says, allows an owner to increase the horsepower to 320 while a piston kit will add another 20 hp. A kit also is available to replace the three-place cabin with a four-place cabin.

Chance Vought Gets Crusader Contract

A $58 million Navy contract for continued production of F8U-2N Crusader jets has been awarded to Chance Vought Corp.

The F8U-2N is an all-weather, carrier-based fighter with ability to detect and destroy targets at night or during inclement weather.

NASA Names Ames To Research Post

Milton B. Ames, Jr., has been named deputy director of the Office of Advanced Research Programs in the National Aeronautics and Space Administration.

The office is responsible for advanced research in aeronautics and space conducted or sponsored by NASA. Ames was graduated from Georgia Institute of Technology in 1936.

(Advertisement)

RBW FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By Fred E. Graves

Why cap screws instead of studs?

Many types of products once fastened with studs are today assembled with cap screws. Why the change in preference?

Studs show certain advantages in large diameters and in high temperature applications. But when it comes to smaller sizes used in tapped holes, designers and production people have found more advantages in cap screws.

ASSEMBLY FACTORS

In fastener selection for a given application, you have to consider production and assembly as well as joint strength.

Obviously, studs require two wrenchings (first stud, then nut). Also, there's a more expensive close tolerance tapping job, since a stud takes an interference fit to stay tight and not withdraw when nut is backed off.

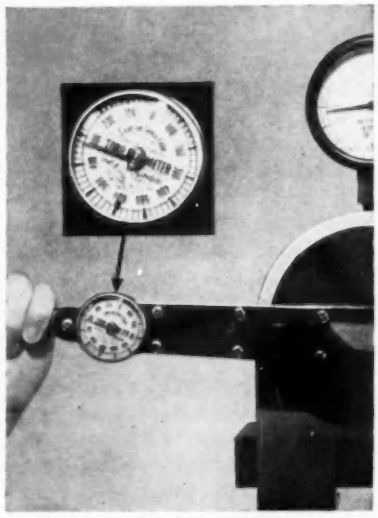
Cap screws require only a clearance fit. Used in a tapped casting, they can be repeatedly inserted and unscrewed without damage to threads.

HOW NOT TO USE STUDS

Studs are not meant to serve as dowels to locate and line up for fastening. To line up numerous studs and bring two pieces together raises assembly cost. Use dowel pins for alignment and use cap screws for fastening to achieve greater economy.

Screw develops high thread tension . . . and stays locked in place

RB&W TENSILOCK screw, despite the friction of the toothed flange, develops 4000 pounds tension with on-torque of 240 inch-pounds.



An off-torque of 330 inch-pounds fails to break loose the grip of the teeth. Tension is maintained by TENSILOCK screw.

Here is a locking fastener where the on-torque effort not only *anchors* the screw but also develops high preloading, or residual tension.

Like high tensile cap screws, RB&W's TENSILOCK* screws also give a high thread tension to torque ratio. But there's one important difference. The TENSILOCK fasteners lock with *teeth* as well as high residual tension.

RATCHET-LIKE LOCKING

Carburized teeth on flange of this one-piece fastener are so angled as to afford easy torquing. They bite into the seating surface when fastener is fully tightened. A circular groove in the flange increases flexing action and enables flange to maintain pressure on the imbedded teeth. To *loosen* a tightened TENSILOCK fastener thus takes much more effort than the on-torque. And it can be reused with little loss of this holding power.

FRICTION STOPS SLIPPAGE

The full clamping force exerted by these fasteners prevents slippage of the fastened members where lateral movement is possible because of large or eccentric holes. The positive gripping enables them to stay tight even under conditions of severe vibration or cyclic temperature fluctuations. RB&W TENSILOCK nuts also available. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

*Trademark Pat. applied for

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa., Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

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MEN IN THE NEWS

Pacific Car and Foundry Co. — Donald F. Pennell has been appointed vice president and general manager of Peterbilt Motors Co., a subsidiary.

Eaton Mfg. Co., Stamping Div. — Howard B. Gordon has been named purchasing agent.

ACF Industries, Inc., Carter Carburetor Div. —Kennard F. Miller has been appointed manufacturing manager.

Bunting Brass and Bronze Co.—Harry G. Schwab has been named director of manufacturing.

Gabriel Co., Gabriel Div.—Charles E. Rupel has been promoted to comptroller.

American Motors (Canada) Ltd.—Earl K. Brownridge (left) has been named executive vice president and general manager. Temco Aircraft Corp.—Clyde Skeen has been named vice president and general manager.

Borg-Warner Corp., Warner Automotive Div.—**A. K. Hahn** has been appointed treasurer and comptroller.

Lindberg Engineering Co.—**Harold A. Moffat** has been named salt bath specialist.

Ford Motor Co., Ford Div.—**Floyd O. Fason** has been named manager of Twin Cities assembly plant.

General Motors Corp., Central Foundry Div.—**Charles E. Drury** has been named divisional director of reliability; **Thomas E. Smith** has been promoted to manager of the Danville plant; **Dale W. Wonus** has been named plant production manager, and **Elmer E. Braun** has been named works manager.

Budd Co. Automotive Div.—**Albert J. Jehle, Jr.,** has been named general sales manager.

Chrysler Corp., Dodge Div.—**Paul E. Butcher** has been promoted to national dealer placement manager.

Timken Roller Bearing Co.—**R. L. Frederick** has been promoted to executive director, International Div.

ACF Industries, Inc., Carter Carburetor Div. — **Lyle V. Mantin** has been named advertising manager.

Bendix Aviation Corp.—**George E. Stoll** and **A. P. Fontaine** have been elected executive vice presidents.

Chrysler Corp.—**Frank Fraser, Jr.,** has been promoted to manager of sales programming for Plymouth-De Soto-Valiant Div.

Ford Motor Co., Aeronutronic Div. —**A. Clyde Flackbert** has been appointed manager, tactical weapon systems operations.

Gould - National Batteries, Inc.— **Milton E. Kluge** has been promoted to chief industrial engineer.

General Motors Corp., Fisher Body Div.—**Leonard H. Klaasen** has been promoted to general factory manager for all Fisher fabricating plants.

B. F. Goodrich Co. — **Charles D. York** has been named staff superintendent; **John S. Bond** has been promoted to eastern manager of fleet sales and **Van L. Wanselow** has been named Milwaukee manager.

Sperry Rand Corp., Vickers, Inc., Div.—**Dr. W. Wai Caho** has been appointed chief of research.

Clevite Harris Products, Inc.—**John J. Carlin, Jr.,** has been appointed sales manager.

Robert Bosch Corp. — **Harry W. Drescher** has been named vice president and head of engineering division and **William J. Finnell** has been appointed manager, manufacturers sales division.

General Motors Corp.—**Edward A. Bracken, Jr.,** has been promoted to manager of special projects on the public relations staff; **Carl Pearson** has been named engineer in charge of new machinery and equipment department, and **W. Arthur Fletcher** has been appointed staff engineer in charge of advanced engineering.

Douglas Aircraft Co. — **Harold G. Hynd** has been named vice president-general manager, Long Beach Div.; **Jesse L. Jones** has been named vice president-general manager El Segundo Div. and **John R. Allen** has been promoted to general manager, Tulsa Div.

Necrology

Earle S. MacPherson, 69, retired vice president-engineering of the Ford Motor Co., died last week in Detroit.

J. J. Timpy, 63, American Motors vice president, died last week in Detroit.

Robinson G. Lapp, 51, a self-taught aeronautical engineer, died Jan. 22 in Buffalo, N. Y. He was project engineer for the Bell X-2, world's fastest manned aircraft.

William G. Power, 63, retired advertising manager of the Chevrolet Div. of General Motors Corp., died Jan. 23 in Detroit.

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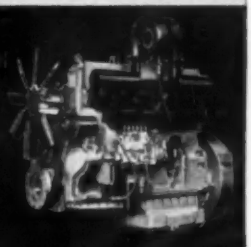
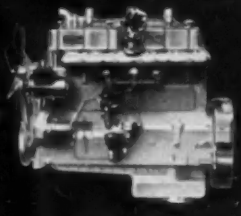
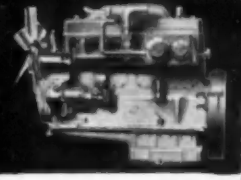


WAUKESHA 145-GZB HIGH OUTPUT GASOLINE ENGINE
5½x6" bore and stroke 817 cu. in. displ., up to 268 hp. at 2400 rpm.



WAUKESHA WAKB BUTANE-PROPANE ENGINE
6¼x6½" bore and stroke, 1197 cu. in. displ., up to 300 hp. at 1800 rpm.



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an Editorial

The 1960 Trend

INDUSTRIAL ANALYSTS ARE REPORTING to top management executives that 1960 will be the best year ever, for the National economy as a whole. They predict that industrial production will increase at twice its historic rate. Capital expenditures have picked up momentum. In almost every plant in the automotive industry, the trend is evident in the in-plant arrangements being made to either install immediately or to prepare to install new production equipment. Incoming shipments reported by plant managers have included deliveries of as many as 10 new machine tools per week in some plants. Inventories and stockpiles of materials are being built up at a rapid rate, but high production schedules are chewing up as much of these materials as are being delivered in many plants. New machine tools for 1961 model production use are being lined up now.

THE AUTOMOTIVE PRODUCTION RATE for the first quarter is 8 million units and economists predict that the rate will be continued through the second quarter. Engineers within the industry are working at a hectic rate with design specialists and other executives concerned with the introduction of next year's models. Their concentration of major activities is so intense that it leaves little time for attention to activities which are not vitally productive. In brief, the total activities of the entire field of automotive industries are moving ahead at a peak pace.

IT DOES NOT REQUIRE A CRYSTAL BALL to enable an analyst to predict that there will be changes in the economic reports of the industry during the third and fourth quarters of the year when new models are introduced. But it is appropriate to point out that when occasions arise during which the peak operations of the industry ease off, such periods provide a very necessary breathing-spell during which design, engineering, management and production men take additional time to give attention to new suggestions and recommendations for further improvement development or adaptation of new materials, methods and equipment to the production operations of the industry.

DURING RECENT IN-PLANT VISITS many interesting examples were observed which illustrate the necessity for a constant flow of design and production information to the industry. During peak production periods, automotive executives read and compare new data and information with current operations, and assign products, equipment, processes and methods for investigation and analysis in a relentless search for new solutions to immediate problems. Many kinds of decisions are made because they have both a short-term and a long-range effect on automotive product designs and production. The pressure of peak operations creates the necessity for decisive actions. Such decisive actions are creating record purchasing volumes at this time.

WHEN LESS-THAN-PEAK OPERATIONS APPEAR, additional kinds of problems move up on the schedule for solution. These may affect decisions in company-wide policies which reach beyond the limits of immediate peak production in-plant operations. In the total cycle of the industry, from the peak of one cycle to the peak of the next, it is quite likely that every important opportunity for improvement of products or production will have been considered by the industry. This capability of analyzing the whole universe of design and production technology during any typical cycle of the industry is a basic reason why this industry contributes so much to the Nation's total productivity. It explains also why this industry contributes so much to this country's record in total economic activity, now expects to reach a new high peak in 1960. It is singularly appropriate for automotive manufacturing to be the pace-setter for the country in the opening year of the decade which has been described as the "dynamic '60s."

Horton W Barclay

Editor and Publisher

Geared with Fuller ROADRANGER ... The Willett Company is using 61 Fuller-equipped GMC and International Tractors, operating from 5 terminals, for bulk hauling in the Chicago area.

Willett conquers city traffic and toll roads

"Our R-46 ROADRANGER Transmissions have achieved an excellent record," says Walter Neumann, Director of Purchases for The Willett Company, Chicago. "They help our drivers maintain fast trip times whether they're creeping in city traffic or running at top legal speed on the toll roads in our operating area.

"Our drivers really appreciate the 8 forward speeds with short, progressive steps between ratios, shifted with a single lever."

Willett uses 61 International and GMC Tractors equipped with semi-automatic R-46 ROADRANGERS for bulk hauling in the Northern Illinois-Northern Indiana area. Payloads for the bulk operation run as high as 50,500 pounds with the most modern trailers used by Willett.

Ask your truck dealer about the Fuller Transmission best suited to your particular operation.

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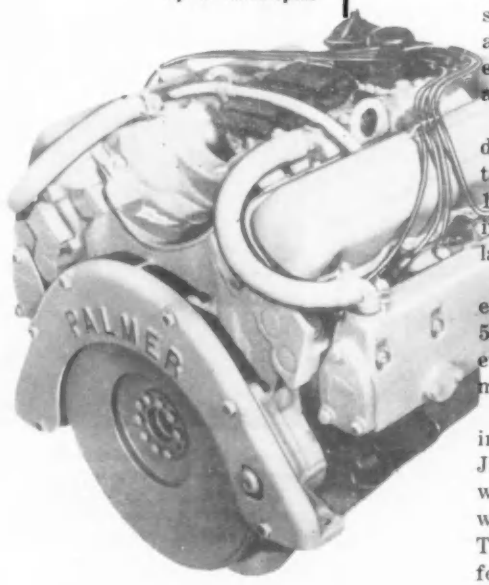
NEW ENGINE DEVELOPMENTS *at* NATIONAL MOTOR BOAT SHOW

Orders Placed at Exposition Totaled an Estimated $32 Million—for Boats, Engines and Accessories

By Charles A. Weinert

EASTERN EDITOR



Palmer's IH-V345, one of two new V-8 gasoline inboards, weighs 900 lb, has a total piston displacement of 345 cu in., and is rated 200 hp at 4000 rpm.

As is always the case, the National Motor Boat Show this year was extremely attractive and interesting. Sponsored by the National Association of Engine & Boat Manufacturers, and held in New York's Coliseum on January 15-24, it was also the Golden Anniversary of this annual event.

Attendance at the exposition was 403,300, reflecting the mushrooming interest of the public in recreational boating. The industry's volume of business last year was the highest yet—up almost 20 per cent over the prior record-level of 1958—and forecasts for 1960 indicate still another record-breaking year in prospect (see AI, Jan. 15, page 73).

Striking evidence of the continuing boom in this industry was demonstrated by the order activity during the show in New York.

"Conservative estimates" of the values of orders booked by exhibitors total $32 million—up about 18 per cent from 1959's show. Orders were placed for more than 22,000 boats, valued at $13 million. Outboard and inboard engine orders are estimated at $12 million, while orders for marine accessories and equipment have been computed to be $7 million.

In announcing this performance, Fred L. Hewitt, Jr., president of the National Association of Engine & Boat Manufacturers, commented that the recreational boating industry in 1960 will probably achieve an overall sales volume approaching or exceeding $3 billion. Industry sales at the retail level last year were recently estimated to be $2.475 billion.

The show itself presented 440 colorful exhibits of boats, engines, and marine accessories. Boats on display numbered 516 and ranged in size from 7½ to 46 ft in length. Twenty-eight of the exhibitors showed inboard engines and outboard motors, both gasoline and Diesel.

The majority of the new engines at the show were described in the article which appeared in AUTOMOTIVE INDUSTRIES for January 15, page 75. However, data on several of them—which include prototypes of new and unusual developments—were not available in time for inclusion in the prior article. These additional engines are therefore being covered in the following:

Crusader's new Mark 325 V-8 is a 390-cu-in. gasoline engine, rated 325 hp at 4800 rpm. It has a 9.5 to 1 compression ratio, and is equipped with twin four-barrel downdraft carburetors.

Scott R-120 experimental outboard motor has four cylinders arranged radially. This two-stroke gasoline engine, with a rating of 110 hp at 4200 rpm from a displacement of 90 cu in., is fitted with a fuel injection system.

American Marc, Inc.

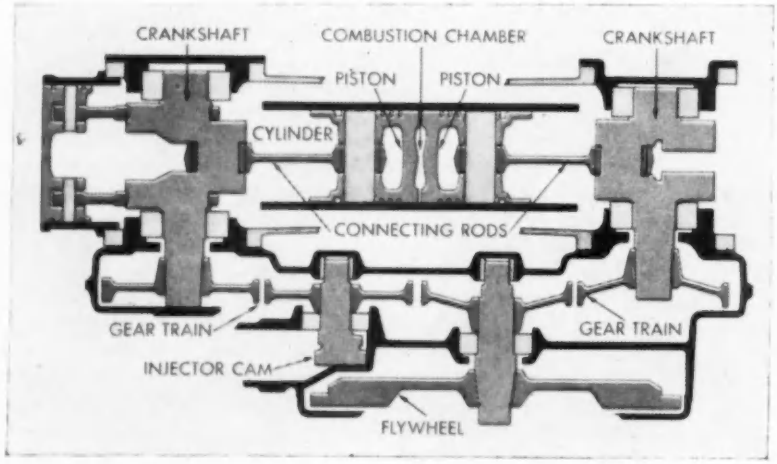
This builder, who introduced a 7½-hp aircooled Diesel outboard motor about two years ago, is now offering a 9¼-hp Diesel outboard production-model called the AMARC 10. Rating is at 3500 rpm. The new watercooled two-stroke unit has a single cylinder with a bore of 2⅝ in. and two opposed pistons, each having a stroke of 2 in. The two crankshafts are geared to the output shaft. Total piston displacement is 21.5 cu in., and compression ratio is on the order of 20 to 1.

Fuel is metered and injected by a simplified fuel injection system timed by a cam on one of the gear-train shafts.

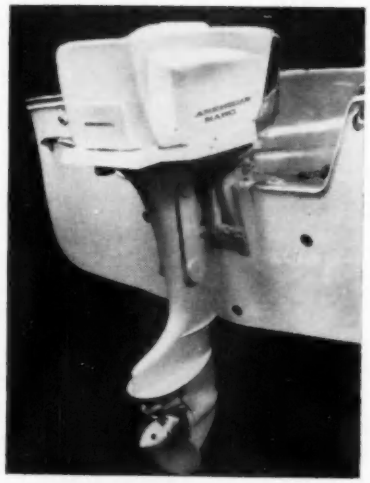
The engine is crankcase scavenged. Anti-friction bearings are used liberally—on both ends of each of the two connecting rods, for crankshaft mountings, in the gear train, and on the output shaft.

American Marc also makes single and twin-cylinder four-stroke Diesel engines for marine, industrial and military use. Aircooled models have ratings of 6.5 and 14 hp at 1800 rpm; while the watercooled models are rated 7 and 15 hp at 1800 rpm. They are sold as separate engines, as well as in the form of motor-generator sets.

Company officials indicated that



Schematic cross-section of the AMARC 10 Diesel outboard



The AMARC 10 Diesel outboard has a single cylinder with opposed pistons. It is rated 9¼ hp at 3500 rpm; and cruising fuel consumption is said to be less than 0.5 gph.

later this year the firm will produce engines of higher horsepower—including an automotive Diesel for application in taxicabs.

Cary Enterprises, Inc.

Among the displays of this Huntington, N. Y., company was a new 3.2-hp "water jet" outboard motor. It is aircooled, and the power section drives a centrifugal pump for propulsion.

The single cylinder motor has a displacement of 5.4 cu in., and weighs 36 lb. Its maker is Garelli Co., Milan, Italy.

The complete unit swivels 360 deg, thus providing for reverse operation. Having no propeller, it is adaptable to safe operation in shallow water and through accumulations of silt, weeds, roots and similar obstacles.

Available as optional equipment is an accessory attachable to the foot of the motor which enables it to serve as a bilge pump for pumping water at the rate of 50 gpm.

Crusader Marine

Last year this builder's top offering was a 348-cu-in. gasoline inboard with a rating of 300 hp at 4800 rpm. While this basic size is still being continued, it has now relinquished its power position in the line to a new larger V-8 rated 325 hp at 4800 rpm.

Designated the Mark 325, the new 390 cu in. ohv engine is based on a Cadillac cylinder block. Its bore and stroke are 4 in. by 3.75 in. Compression ratio is 9.5 to 1, and it is equipped with twin four-barrel downdraft carburetors and high-lift cams. Total weight of the engine with hydraulic clutch is 800 lbs.

Two other versions of the basic Mark 325 are available in the Mark 300 and Mark 275. The former is rated 300 hp at 4400 rpm, and is equipped with a single four-barrel downdraft carburetor. It likewise has 9.5 to 1 compression ratio. The Mark 275 is rated 275 hp at 4000 rpm, has an 8.8 to 1 compression ratio, and is equipped with twin side-draft carburetors.

In addition to the 390-cu-in. series, Crusader is offering the Mark 240, 348-cu-in.; and the Mark 225, 200, 170 and 140, 283-cu-in. models—all of which are ohv V-8's.

Cummins Engine Co.

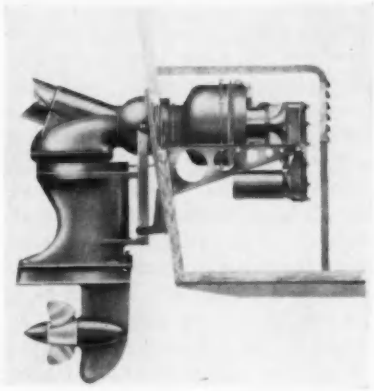
Featured engine in the Cummins' show exhibit which comprised three marine Diesels, was the VT-12-M. Rated 600 hp at 2100 rpm, this engine is a V-12 with a total piston displacement of 1486 cu in. Its bore and stroke are $5\frac{1}{8}$ in. by 6 in. It weighs 6100 lb, and measures $70\frac{3}{4}$ in. long, 44 in. wide, and $64\frac{1}{2}$ in. high.

Cummins also showed its NRTO-6-M, a six-cylinder Diesel with a total piston displacement of 743 cu in., rated 335 hp at 2100 rpm. This engine has a net weight with standard accessories, but less reverse and reduction gears, of 3050 lb.

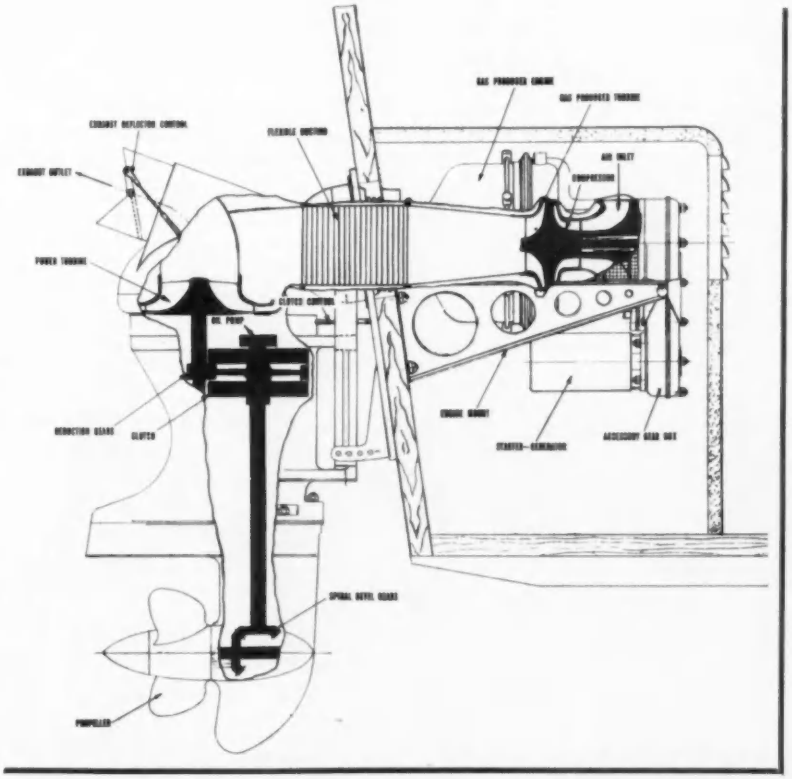
The third model displayed was the JT-6-M inboard Diesel, rated 175 hp at 2500 rpm and having a total piston displacement of 401 cu in. It is a six-cylinder vertical unit, with a direct-drive weight of 1950 lb.

All of the models shown were turbocharged, and of the four-stroke type.

(*Turn to page 92, please*)



The "Turbinautic," introduced by Precision Gears & Products, Inc., combines an inboard-mounted gas turbine engine with an outboard-mounted drive. Weight of the package is stated to be less than one pound per horsepower.



Sectional view of the "Turbinautic" gas turbine and drive assembly. Flexible ducting between the engine and drive permits the latter to be turned for steering.

Design and Production Highlights of Rolls-Royce Aluminum V-8 Engine

PART II

By David Scott
Special European Correspondent
for AUTOMOTIVE INDUSTRIES

PRODUCTION activities at Crewe are confined largely to machining, assembly and inspection. In many cases, such as the cylinder block, machining is complicated by the design of components which have been conceived with little regard to cost, as well as by the close tolerances laid down. Manufacture takes a back seat to design, and at most the engineering department can suggest, not demand, minor changes to ease production. On occasions small modifications have been accepted when no compromise with quality was involved.

Machine tools are mainly standard types, although a few special units are used. Flexibility is the keynote, with emphasis on good fixtures. This is not only because output at Rolls-Royce is relatively small, but because design details are continually being changed and improved as a matter of policy. Versatility is also important, for production is in batches and some machines may make as many as 20 different components in a week.

Tools in the cylinder block section are linked by roller track, and the line starts with a plano-miller that faces the front and rear of the 85-lb aluminum casting with rough and finish cuts. Lateral faces are then surfaced on a Wadkin high-speed router miller with the work clamped in a trunnion-mounted, multi-sided fixture.

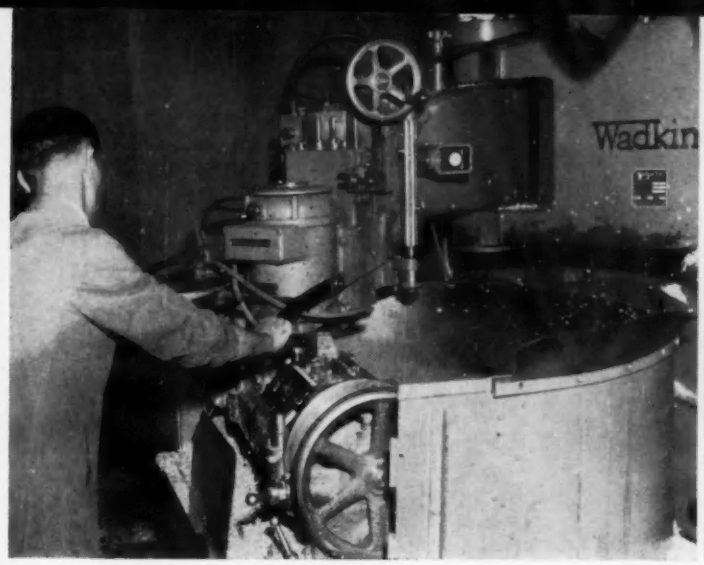
The cutting head is carried on hinged arms to move freely in a horizontal plane, and is manually passed over the work by the operator. Between operations the fixture is indexed by a hand wheel to present the next face upwards, and height of the spindle head is reset by positive stops controlling its position on the vertical slide. Where required there are guide templates on the fixture to restrict cutter movement to the desired area.

Head, pan and camshaft cover faces are finished on this one machine. Rolls-Royce derived this method of machining aluminum from aircraft practice, employing it because of its speed and the near-perfect flat surface it produces.

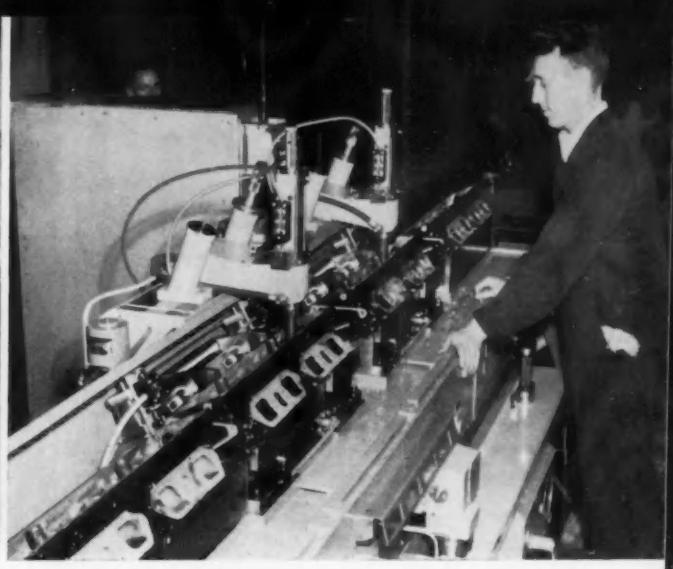
Crank and cam bearings are finish-bored on a twin-spindle Landis Lund Precimax with outfeeding tools. These operations are carried

Crank and cam bearings are simultaneously finish-bored on this two-spindle Landis Lund Precimax to insure exact centering and location of the two shafts. Boring bars with outfeeding tools are supported by roller bearings in the steady behind the fixture.

V-8 cylinders are bored, grooved to take three sealing rings, and recessed to seat the liner flange in one operation with 11 outfeeding and interconnected tools on each of the horizontal spindles. Costly multiple tooling is used to insure concentricity and squareness, not to save time.



Cylinder heads are faced on a Wadkin high-speed miller with the work clamped in a rotary fixture that is indexed by hand between operations. Combustion chambers are fully machined by a smaller cutter, when a guide template is positioned over the lower face.



Valve guide holes and recesses for seat inserts are bored on a Krause machine with two upward-feeding vertical spindles. After inserts are pressed into the head, the tool bars are changed for final boring. The table with dual fixtures indexes between strokes so that all the exhaust and then the inlet valve areas on the two heads are consecutively machined.

out simultaneously to insure exact centering and location of the two shafts. The cylinder block, front end forward, is located on the traveling fixtures by a pair of dowels engaging steel bushings pressed into the pan face, and downward clamping is hydraulic.

With the tools retracted, the work slide fast-feeds in so that the bars pass through the two lines of bores and their noses finally enter support bearings in the steady rest directly behind the fixture. Bar ends are keyed to mate with slots in these roller bearings, and a simple arrangement of interlock switches prevents slide movement unless the bars are aligned.

As the block advances on its work stroke, the crank holes are bored to 0.015-in. under the final dimension, and the center bearing is recessed for a thrust washer. Meanwhile, the cam bearings are finish-bored and the front one is recessed to take an oil seal. At the end of travel the external flange adjacent to the camshaft is faced by additional outfeeding tools on the upper spindle head.

Blocks are then circulated to several other machines before being returned to this one for finish boring. This is because there are a number of operations, including pressing in the white-metal camshaft bearings, that use the crank bores for location. Final machining of the latter is therefore delayed. Normally a week's production of each is put through at a time.

Tool bars are changed for the final boring, and work covers removal of the remaining 0.015 in. from the crank bearings and boring out the cam inserts to 2⅛ in. ±0.00025.

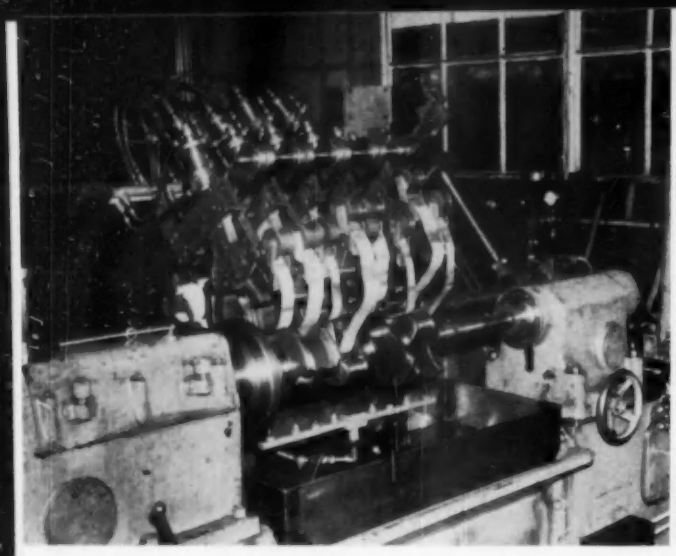
Cylinders are bored to take the wet liners on another Landis Lund machine. This unit has two horizontal spindles spaced to match a pair of alternate cylinders on one bank, and features extremely complex tooling. Each boring bar incorporates 11 outfeeding and interconnected tools, and in one cycle it roughs and finishes the upper and lower diameters, counterbores the upper recess that seats the liner flange, and cuts the three grooves for the rubber sealing rings. Grooving is done in five passes, after which the sharp edges are chamfered.

This costly multiple tooling is employed not to save time by doing all the work in one sequence, but to insure that all machined areas relating to the cylinder liners are square and concentric. The block is mechanically clamped in an angled fixture, and is located on its pan face by the same steel-bushed dowel holes. Between borings the work table cross-traverses hydraulically to present the second pair of cylinders. To machine the opposite bank the block is manually repositioned in the fixture.

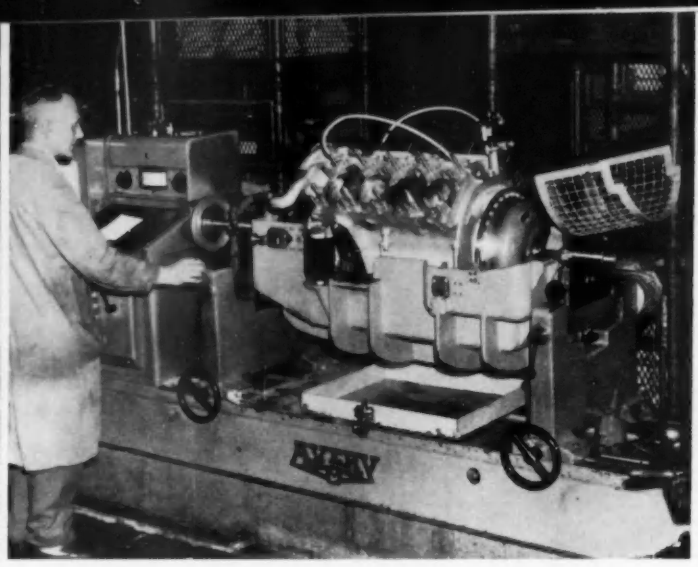
Cylinder liners are externally machined on a Drummond Maxi-pilot multi-tool lathe, finish-bored on a two-spindle Ex-Cello, then honed on a single-spindle Gehring. This last operation is noteworthy in that Rolls-Royce has replaced the air gage normally fitted in the reciprocating honing head by a separate Solex air gage that measures the bore at three spaced-out diameters instead of merely providing a single average reading.

Thus ovality and taper can be checked precisely, and the latter corrected by manually limiting the spindle stroke to the under-size section when the liner is returned to the machine. Although this procedure considerably lengthens production time, since each liner is shifted between machine and gage several times, it is felt to be justified on the grounds of precision.

Cylinder heads are machined on another Wadkin high-speed miller, with the hand-rotated fixture indexing to present the top, mating and both manifold faces to the horizontal, hand-guided cutter. For milling combustion chambers an additional template with four cut-outs is clamped over the lower face, and the cutter is replaced by a smaller one. The spindle runs at 18,000



All nine crankshaft bearings are simultaneously lapped on this special machine built by Rolls-Royce. Abrasive paper is clamped to the mains and pins by air-actuated jaws carried on independent pivoting arms, and bearings are sprayed with oil from beneath when the shaft is rotated.



Completed engines with heads removed are dynamically balanced at 750 rpm on this Avery machine. Front corrections are made by drilling the vibration damper flange, while strip weights, graded down to half a gram, are bolted to the starter ring at the rear.

rpm, and carbide-tipped tools are used since the high-silicon aluminum alloy is very abrasive.

Valve guide holes and recesses for seat inserts are bored on a Krause machine with a pair of upward-feeding vertical spindles. These have compound tooling for the exhaust and inlet valves respectively. The work table has double fixtures to carry two cylinder heads which are indexed transversely over the retracted spindles so that the line of exhaust and then the inlet valve areas are consecutively machined.

On the initial cycle the guide hole is bored while the seat recess is counter-bored by an outfeeding tool. This is done in batches of 100 or so at a time, after which the inserts are pressed into the heat-expanded heads. For final machining the tool bars are changed and the spindle speed lowered. Here the guides are bored and then pilot-reamed with overhanging steady rests supporting the bar extensions.

At the same time a single-point tool cross-feeds at an angle to face the valve seats. Tolerance on the guide bores is kept to ±0.00025 in. As with the cylinder boring, multiple tools are used to maintain precise alignment of the guides and seats.

The crankshaft is a steel forging with integral balance weights. Diameter of the five main bearings is 2.5 in., and the 90-deg crankpins have 2.25-in. diameters and are 2 in. wide to accommodate paired connecting rods.

Before machining the forgings are dynamically mass-balanced and centered on a Jackson & Bradwell unit. Mains and weights are then turned simultaneously on a Drummond Maximatic, after which the pins are individually turned on four separate similar lathes. These are universal machines that are reset to take the 4-, 6- and 8-cylinder cranks for in-line industrial engines also made at Crewe.

Oil holes are deep-drilled on a special double-headed Archdale, with the fixture indexing forward after each throw has been correctly positioned. Following grinding, the crankshafts are finally balanced on

(*Turn to page* 100, *please*)

Every fiftieth engine off the line is run for 6 or 7 hours on a brake, then 100 per cent stripped and each part is individually gaged for wear. The entire operation, including reassembly, takes two days.

Highlights of SAE Annual Meeting

PART 2

By Charles A. Weinert
EASTERN EDITOR

PART I of this two-part report on the SAE Annual Meeting which was held in Detroit on January 11-15, appeared in the February 1 issue of AUTOMOTIVE INDUSTRIES (page 44). The second part follows, opening with a *continuation* of technical-session observations and concluding with high-spots of the SAE Engineering Display.

TECHNICAL SESSIONS

Air Cushion Vehicles: Considerable interest in air-cushion vehicles—or what the experts seem to prefer to call ground-effect machines — was displayed by the large attendance at the session devoted to developments along these lines.

Two Ford engineers, A. L. Haynes and D. J. Jay, explained the basic principles of the "Levacar," which is supported and slides along a tissue-thin film of air and is guided by a metal rail. They talked in terms of potential vehicle speeds above 200 mph, and said that sliding is the only alternative. Wheels are not adequate for high-speed ground transportation in excess of the 150-200 mph range, they feel, because "vibrations set up, wheels begin to lose traction, and directional stability disappears."

This type of vehicle is pictured as being applicable in mass transportation where stops are 100 miles or more apart. While such a vehicle would ride on a cushion of compressed air, forward propulsion would be by propellers or jet.

The basic principles of ground-effect machines in six different configurations was the subject of a paper presented by G. D. Boehler of Aerophysics Co. It is good reading for those desiring an introduction to this type of vehicle.

A Navy engineer, H. R. Chaplin of the David W. Taylor Model Basin, discussed in a highly technical presentation the potentialities of over-the-water craft. He

(*Turn to page 76, please*)

EXHIBITORS IN SAE ENGINEERING DISPLAY

Aeroquip Corp.
Al-Fin Div.,
Fairchild Engine & Airplane Corp.
Allegheny Ludlum Steel Corp.
Aluminum Co. of America
American Bosch Div.,
American Bosch Arma Corp.
American Sealants Co.
Anchor Coupling Co., Inc.
Armco Steel Div.,
Armco Steel Corp.
Associated Spring Corp.,
B-G-R Div.
Avon Tube Div.,
Higbie Mfg. Co.

Bacharach Industrial Instrument Co.
Bendix Aviation Corp.,
Bendix Filter Div.,
Bendix Products Div.
Bendix Radio Div.
Eclipse Machine Div.
Lakeshore Div.
Marshall Eclipse Div.
Sheffield Corp.
Berryllium Corp.
Bolling Wheel & Axle Div.,
Anderson-Bolling Mfg. Co.

Chelsea Products, Inc.
Chrysler Corp.
Cities Service Oil Co.
Cleveland Graphite Bronze Co.,
Div. of Clevite Corp.
Continental Motors Corp.

Dan Corp.
Dayton Industrial Products Co.,
Div. of Dayton Rubber Co.
Detroit Aluminum & Brass Corp.
Detroit Controls Div.,
American-Standard
Detroit Diesel Engine Div.,
General Motors Corp.
Dow Chemical Co.,
Dow Metal Products Co.
Magnesium Sales Dept.
Dualoc Drive, Inc.

E. I. du Pont de Nemours & Co., Inc.,
Elastomer Chemicals Dept.
Polychemicals Dept.
Electric Autolite Co.
Enjay Co., Inc.

Fawick Brake Div., Fawick Corp.
H. Fischer & Associates, Inc.
Flexonics Corp
Fram Corp.

Garrett Corp.,
Airesearch Industrial Div.
General Radiator, Inc.
Gillett & Eaton, Inc.
Grob, Inc.

Heli-Coil Corp.
Hercules Motors Corp.
Heyer Industries, Inc.

International Nickel Co., Inc.

Johnson Bronze Co.

Kaiser Aluminum & Chemical Sales, Inc.
Kelsey-Hayes Co.
Kistler Instrument Corp.
Kolene Corp.

Lipe-Rollway Corp.
Lisle Corp.
Lord Mfg. Co.

Midland-Ross Corp.,
Owosso Div.
Molded Fiber Glass Body Co.
Monroe Auto Equipment Co.

Perfex Corp.

Reynolds Metals Co.
Rosan, Inc.
Ross Gear & Tool Co., Inc.

Satullo Co.
R. H. Sheppard Co., Inc.
SKF Industries, Inc.
Spray Products Corp.
Stratoflex, Inc.

Thompson Ramo Wooldridge, Inc.
Torrington Mfg. Co.
Tyrex, Inc.

Unison-Action Seat Div.,
American Metal Products
U. S. Steel Corp.

Vickers, Inc.

Walker Mfg. Co. & Deluxe
Products Corp.
Waukesha Motor Co.
Webb Forging Co.
Wyman-Gordon Co.

Zollner Corp.

General view of the Buhr Economatic from one end. Note how the hydraulic pump units are arranged in the aisle away from the machine for easy accessibility

New Transfer Machines at Saginaw Steering

By
Joseph Geschelin
DETROIT EDITOR

A VARIETY of malleable iron gear housings for power steering gears are being produced by Saginaw Steering Gear Division, GMC, for 1960 requirements. The company adapted a Greenlee transfer machine for this purpose several years ago, then rebuilt and retooled the same machine for producing the gear housing for 1959 models. Details of this initial venture were published in AUTOMOTIVE INDUSTRIES, November 15, 1958.

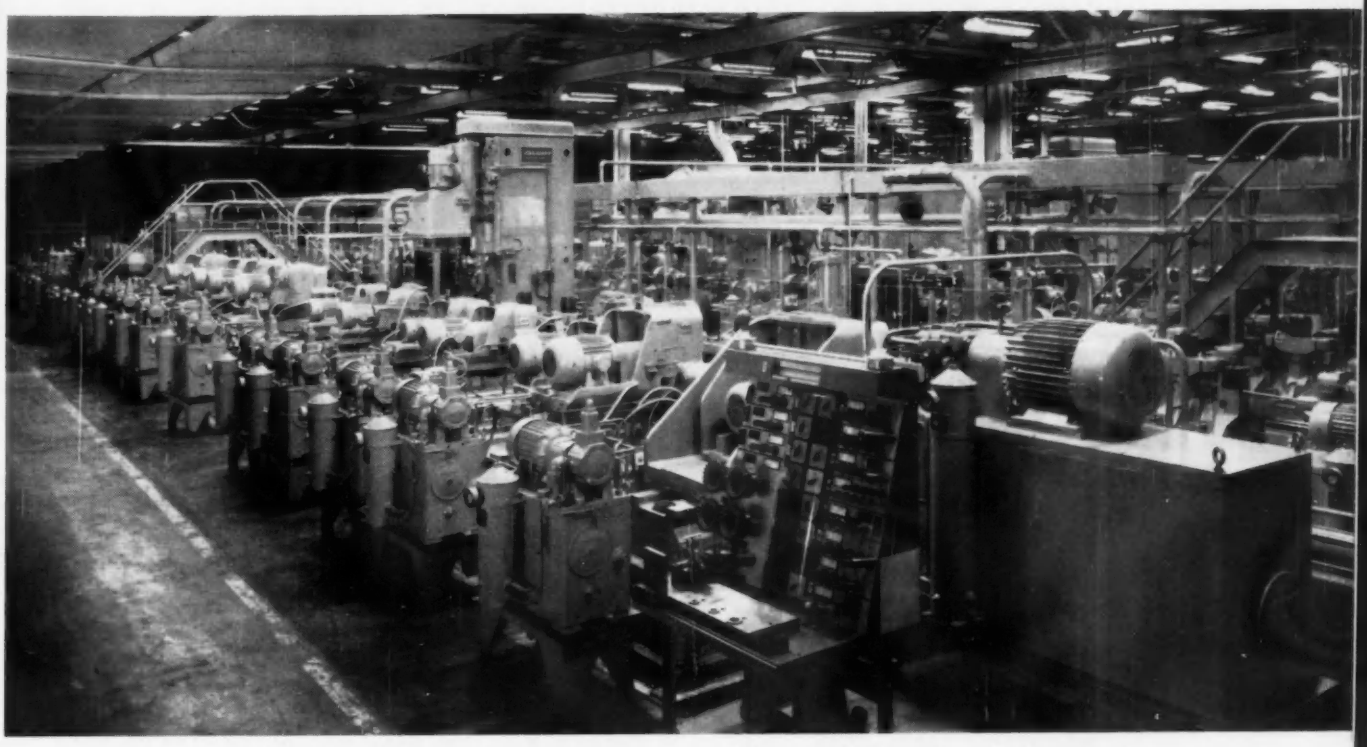
MAKING IMPROVED GEAR HOUSINGS

The gear housing for 1960 production is larger, considerably more complicated from the standpoint of processing, involves finer tolerances and surface finish along with greater emphasis upon the relationships of bores and locating surfaces. Evidently the impact of closely held tolerances, coupled with design complexity, now determines the choice of the manufacturing method.

For example, the division produced a considerable number of 1960 gear housings on a pilot line of conventional machine tools before the new transfer machine was available. Despite great care in tooling and fixturing, the rate of rejects was too high to be profitable. It was obvious that the pallet type machine in which the parts are clamped accurately and securely, and in which the parts never leave the fixture until the cycle is completed, was the best answer. Now, as a matter of fact, the management here has concluded that the only way this part can be processed, with good efficiency and low rejects, is on a pallet type transfer machine.

What is of major interest in this case, is that a transfer machine of the type to be described has become a piece of precision equipment, capable of doing the job better on a large scale than one may expect from small lot production in the tool room.

Principal cross-sections of the 1960 gear housing are illustrated to show the nature of the configuration as well as to indicate some of the rigid tolerance requirements. (See page 68, bottom drawing.) Besides the close tolerances on dimensions, note the requirements of concentricity of bores as well as flatness and squareness. These are the things that dictated the adoption of a very expensive transfer machine. Another major

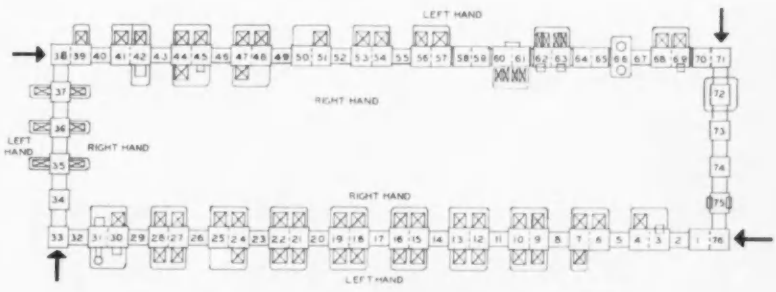


Another view of the Buhr machine, showing one of the many tool boards in the foreground.

Gear Division of GM

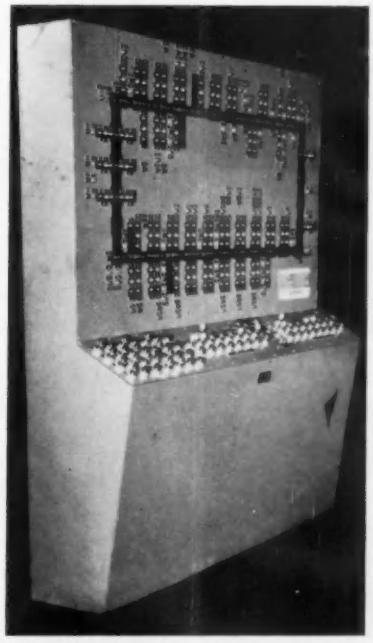
consideration was that the machining cycle is required to remove some 3¾-lb of metal from each piece. Despite this heavy metal removal the machine is expected to produce 300 pieces an hour.

With the exception of flange mounting holes, the entire sequence of operations is performed in one enormous 96-station Greenlee transfer machine. It has 38 working stations, 27 idle stations, and 55 working heads. Arranged in the form of a rectangle, as is common in a pallet type machine, it has a developed length of 508 ft. Accord-



Schematic layout of the Buhr Economatic, pallet type transfer machine for handling the pump housing.

Views and Diagram of
BUHR ECONOMATIC MACHINE
for making cast iron pump housings



Close-up of the special control console for the Buhr machine. It will be noted that the tell-tale neon lights are arranged in the same pattern as are the machine heads.

ing to Greenlee this is the largest pallet type machine built to date. Incidentally, the machine is installed at Plant 2 and was in operation only one day when the writer visited the plant.

Because of initial heavy chip removal, the machine has been arranged in a number of distinct sections, although all of it is tied together by the transfer mechanism. The first section is arranged to take out at least 80 per cent of metal removal. This section is necessarily more massive and is designed for heavy coolant flooding.

FEATURES OF GREENLEE TRANSFER MACHINE

There are many distinctive features embodied in the design of the machine. For example, the housing must be finished in all respects and free from burrs or wire edges. When this machine was designed, the company arranged to have the last section tooled exclusively for removing burrs in holes and other locations, including wire brushes for cleaning up all edges. This is done automatically and with unvarying quality.

Inspection Stations

Another feature is the pull-out inspection station just ahead of the deburring section. This enables an inspector to remove a pallet from the transfer conveyor and slide it out of the machine on a cross conveyor. Management specifies that two pieces must be checked per hour as a sampling inspection. In addition there are six manual inspection stations built along the line at strategic points for checking on work in process.

Idle Section

One section of the line is completely idle to leave space for future expansion or product change. Incidentally, because of the heavy flooding of coolant special attention was given to locating limit switches completely away from the machine heads. Although this entailed special mechanism for switch operation, management felt it was well worth doing in the interest of keeping the equipment running without breakdown. This is particularly sensible when you consider that the machine has 563 limit switches.

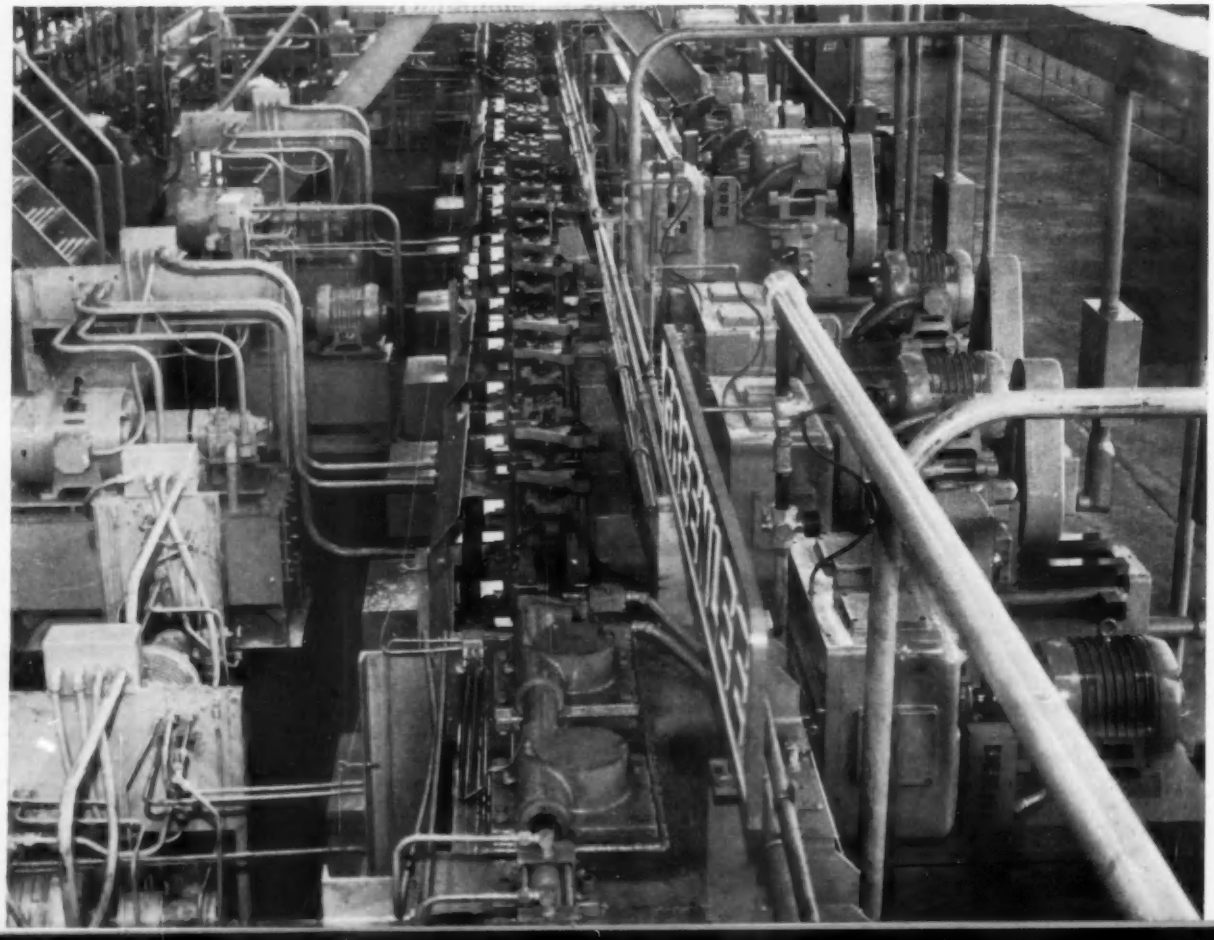
Sequence of Operation

The sequences of operations in the Greenlee will be given in some detail below. Altogether the machine handles 212 operations along 38 working stations and 55 heads with 150 tools in action. There are 27 idle stations, four turnarounds, and four checking stations, including probes.

The machine has 113 electric motors with a total rating of 845 hp. In addition there are 15,000 ft of hydraulic tubing for the hydraulic system.

The sequence of operations is as follows:

One side of the enormous Greenlee transfer machine. The pallet conveyor traverses the machine between the right- and left-hand heads.

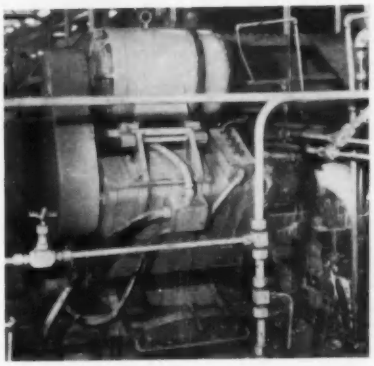


Station	Head	Operation
2	LH	Mill valve body end.
	RH	Mill cylinder bore end.
3	LH	Drill hole part way.
4	LH	Drill hole part way through.
	RH	Comb. rough-bore one large diameter; rough-bore part way for another diameter.
5	LH	Comb. rough-bore, rough-counterbore, chamfer.
6	LH	Complete drilling of one hole.
	RH	Comb. rough-bore large bore part way, counterbore bottom.
7	LH	Comb. rough-face bottom diameter, finish-counter bore, hollow mill.
8	RH	Cut two recesses and thread relief.
	LH	Comb. rough-bore to depth, form-face bottom.
9	LH	Comb. cross face end, cross face bottom.
10	RH	Comb. finish undercut, rough other undercut.
11	LH	Comb. semi-finish-bore one diameter, finish-ream small diameter.
Vertical	RH	Drill into snap ring groove.
12 angular	LH	Drill through one hole.
13	RH	Finish undercut.
16	LH	Rough-mill cover face, mill tap bosses.
18	LH	Finish-mill cover face.
19 comp. ang.	LH	Drill hole half-way.
20	LH	Drill hole to depth.
comp. ang.	RH	Comb. rough-bore, spotface.
21	RH	Rough-bore one hole.
22	LH	Drill six holes.

To conserve space we shall break the sequence at this point. The operations listed above, and including Station 37 which rotates the parts 90 deg, take in the left hand side of the machine. Station 38 is the pallet cross conveyor which transfer the pallets to the right hand side of the machine. The next group of some six stations—with 10 working heads—completes finishing operations. The parts pass the pull-out inspection station, mentioned earlier, then go through a washer on the line.

Following this, the pallets enter

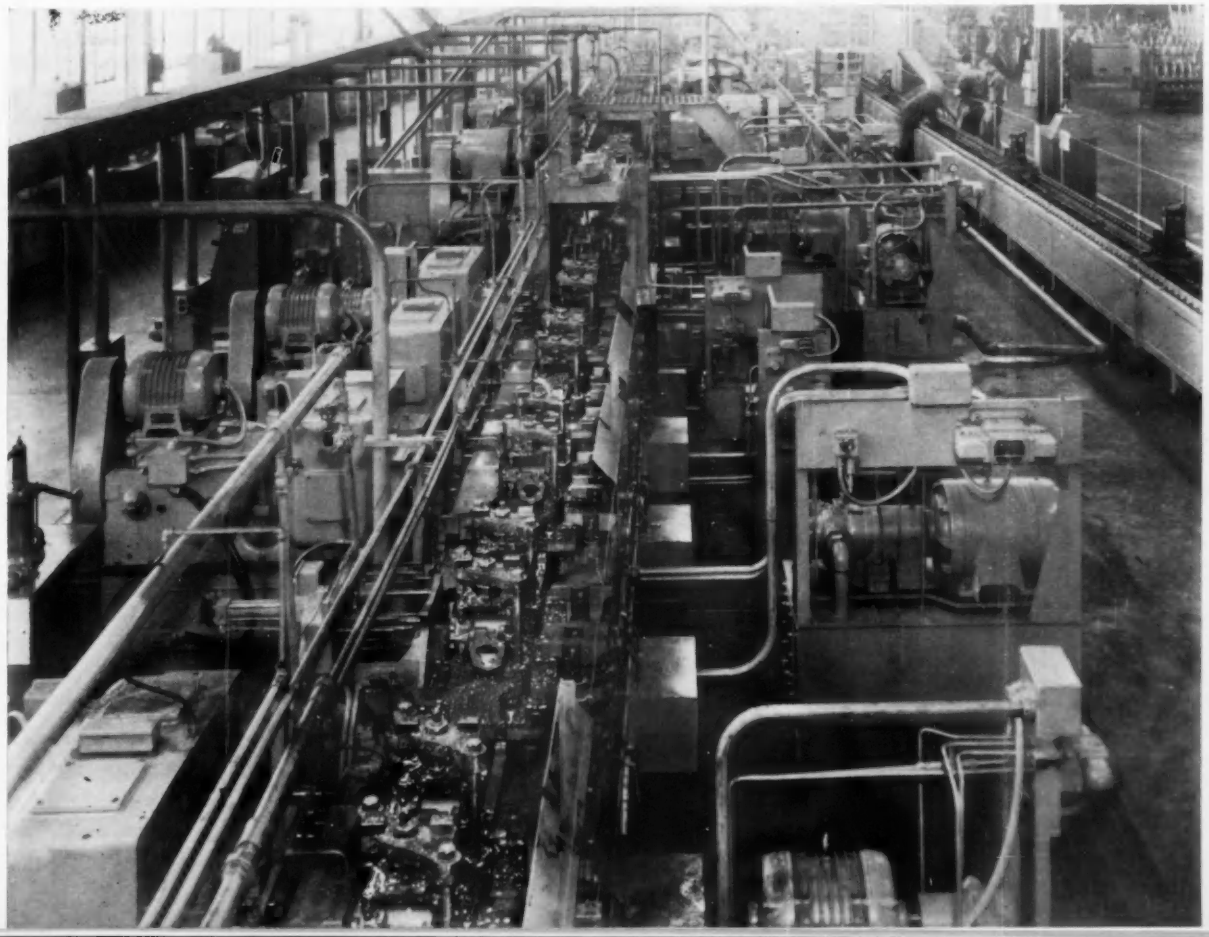
Close-up of station on Greenlee machine, near start of the machine cycle, to show flooding of soluble oil on work during heavy metal removal stages.

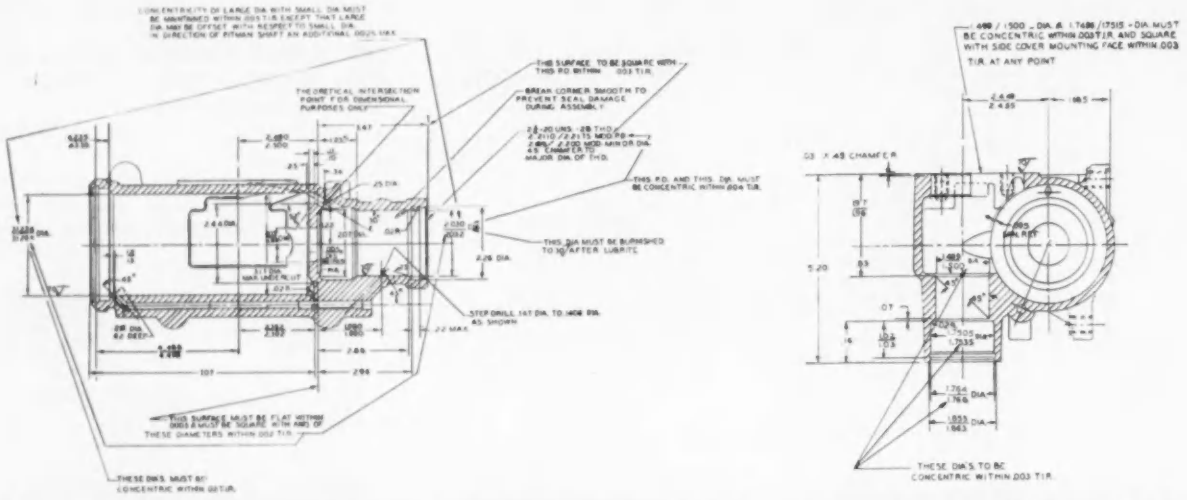


Views of the Enormous GREENLEE TRANSFER MACHINE

for making malleable iron gear housings

Another view of the Greenlee machine, showing the disposition of heads, with Vickers hydraulic cabinets to one side for easy access.





Principal cross-section of the gear housing which is machined completely on the big Greenlee transfer machine. This will indicate the character of dimensional tolerances, finishes, and relationship of critical elements.

the unique section, surely a "first" in transfer machine design—the automatic deburring stations. In all there are 10 of these stations with some 16 working heads. On these stations a variety of holes are deburred, air-blasted in several instances, and the cover face is polished. The pallet transfer line on this side is at Station 29 right hand side. This is the pallet return line to the start of operations on the left hand side of the machine.

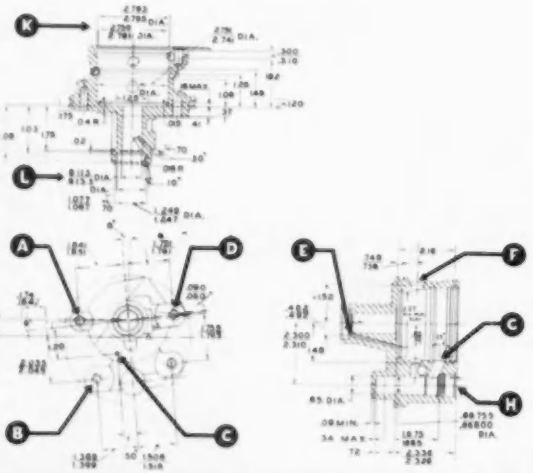
At the end of the deburring line, the machine operator removes the parts, transfers them to the adjacent Cross multiple-spindle drilling machine where the flange mounting holes are prepared to suit the requirements of an individual customer. It may be noted that there is just one operator for the transfer machine. He loads and unloads at his station on the right hand run of the machine; also loads and unloads work in the Cross machine.

BUHR ECONOMATIC TRANSFER MACHINES

Saginaw Steering also makes a variety of cast iron pump housings for power steering. To take care of two current versions, the company is employing two Buhr Economatic transfer machines, both of pallet type. One of these has been in use for some 18 months.

However, the housing illustrated below is of greater complexity and requires considerably more processing. It is being machined in Plant 3 on a newly installed Buhr Economatic transfer machine, illustrated schematically at the beginning of this article. This machine has 76 stations, runs some 280 ft in developed length. As in the case of the other machines this one handles two pieces at a time.

(*Turn to page 87, please*)



KEY TO OPERATIONS PERFORMED

A—Tap drill—86 deep max. 3/8-16 UNC—3 B th'd. .3344/.3387 D.D.—.74 deep min. Pad "D"

B—Tap drill—.64 deep 3/8-16 UNC—3 B th'd. .3344/.3387 P.D. .52 deep min. 2 Holes (pads "A" & "B")

C—Initial machining locating point for machining surface "X" as dimensioned in section B-B

D—Tap drill—.81 deep max. 3/8-16 UNC—3 B th'd. .3344/.3387 P.D.—.69 deep min.

E—Step drill between 1/8 & ±3 2 (0.116) Drill thru as shown, number of steps optional

F—3/8 +.001 −.002 drill thru as shown +.003 1/2 −.002 drill to depth shown 33/64 drill thru one side (optional) 0.567/0.569 dia. to depth shown 3/8 hole must be finished prior to finishing .66755/.66800 hole.

G—25/64 +.001 −.002 drill thru as shown prior to finishing .66755/.66800 hole this corner & chamber to be smooth & free of nicks & burrs.

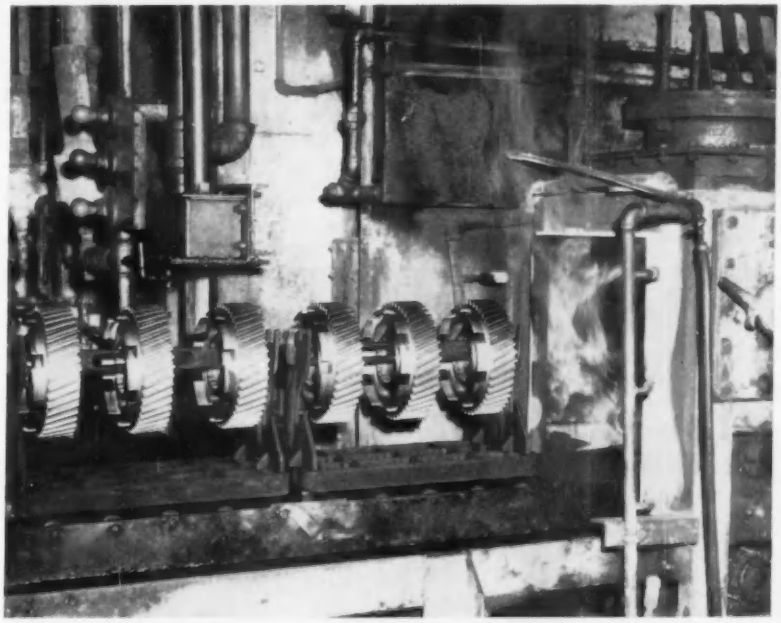
H—11/16 tap drill—1.20 deep 3/8—16 UNF—2B th'd—.74/.80 deep .7094/.7159 P.D. .766/.768 Dia. C ' bore—.45 deep .964/.970 Dia. C ' bore—.045/-.053 deep

K—This diameter must be concentric with center of .188/.189 dia. holes within .004 T.I.R.

L—This diameter must be concentric with center of .188/.189 dia. holes within .006 T.I.R.

Principal cross-sections of the pump housing machined completely on the new Buhr transfer machine. The drawing shows the nature of tolerances and relationship of critical elements.

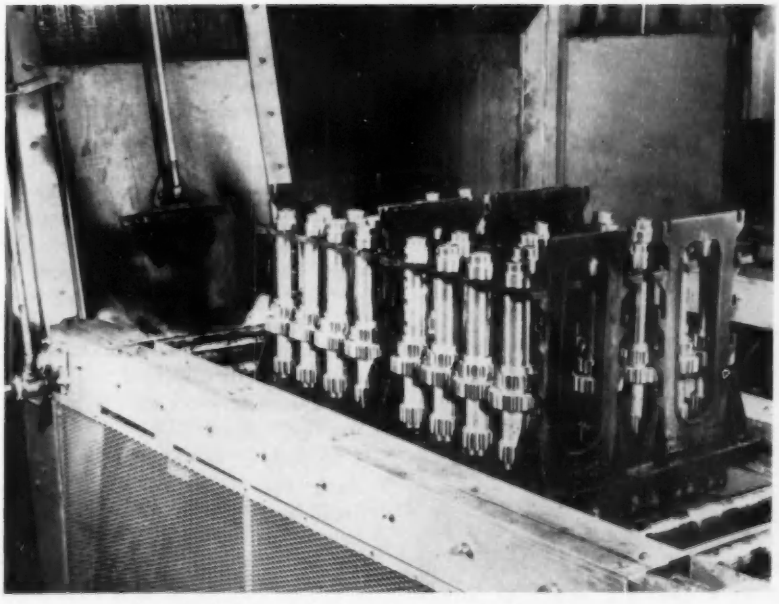
Heat Treatment of Fuller Transmission Parts



Heavy duty transmission gears being charged into Surface Combustion furnace. Upright racking of gears aids heat treatment and quenching.

PRODUCTION of our heavy duty truck and tractor transmissions requires heat treatment of about 75,000 lb of parts a day, six and seven days a week. There are some 6000 different parts involved—thrust washers weighing only an ounce, to shafts weighing as much as 75 lb. Assembled Road Ranger transmissions weigh up to 1600 lb.

Transmission parts requirements are critical. Case depths and core hardnesses are carefully controlled. Carburizing and carbonitriding are carried on in atmosphere-controlled furnaces. We check gas analysis daily and dewpoint every hour on furnaces for which we do not have fully automatic controls. Case depths range from 0.003 to 0.060 in. effective case.



Countershafts ready for charging into Ipsen furnace.

By George M. Travers
Chief Metallurgist
FULLER MANUFACTURING CO.
Kalamazoo, Mich.

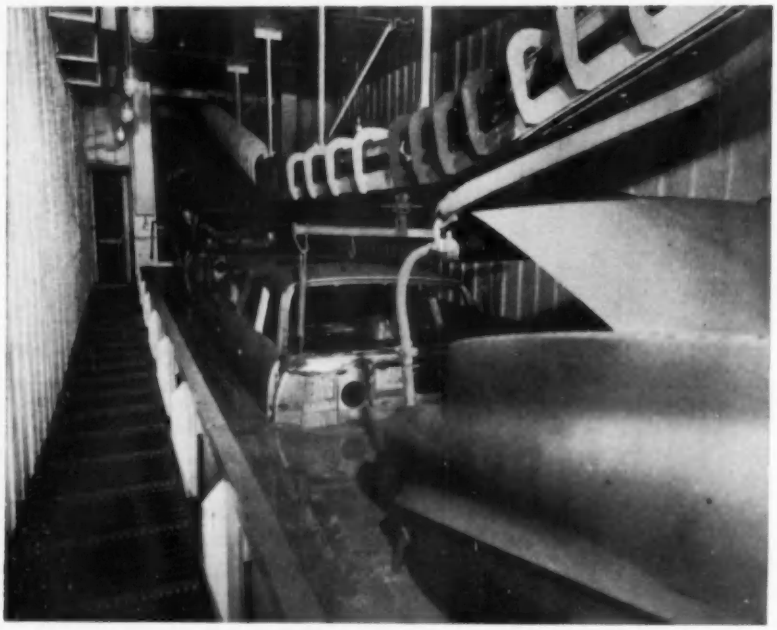
For some heavy shafts, we use 5 per cent nickel steel. This and other costly alloys are needed in today's transmissions. Low-carbon and medium-carbon steels are used for parts requiring minimum core hardness—such as shifting forks and rails, thrust washers, etc.

Use of quenching oil in our operations is substantial. We estimate consumption to be 10,000 gallons a year. The quench oil is re-used repeatedly. We circulate the oil through heat exchangers to cool it for further use. Our main storage tank is 10,000 gallons capacity, and we have a reserve tank of the same size. Our quench oil costs would be substantial if the oil were to break down in service so that it had to be discarded and replaced frequently.

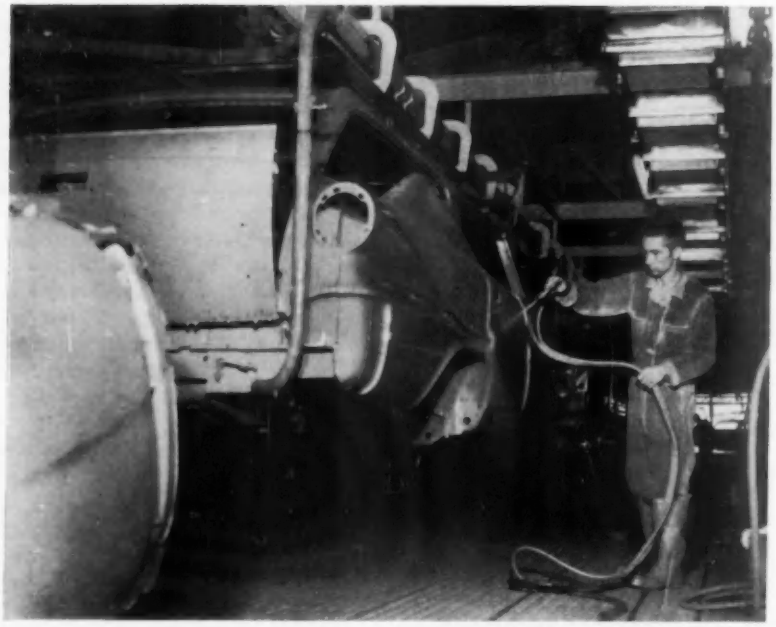
With the volume of heat treating work going on, minimizing distortion in heating and quenching is an important factor. Components must come out of the quench tanks within reasonable dimensional tolerances. Otherwise, excessive straightening would be required

(*Turn to page* 114, *please*)

Body Rust-Proofing and Final Assembly at Chrysler's Delaware Plant



Continuous overhead conveyor carries bodies, in a "roller-coaster" fashion, through seven dip tanks during the rust-proofing process cycle. In the tank illustrated, each body is immersed to a depth of 18 in., for 1½ minutes, in water-dispersed primer paint for the final dip.



On this drain deck, following dipping in water-dispersed paint, the primer is spray-washed off the exterior sides of body panels before curing.

PART I

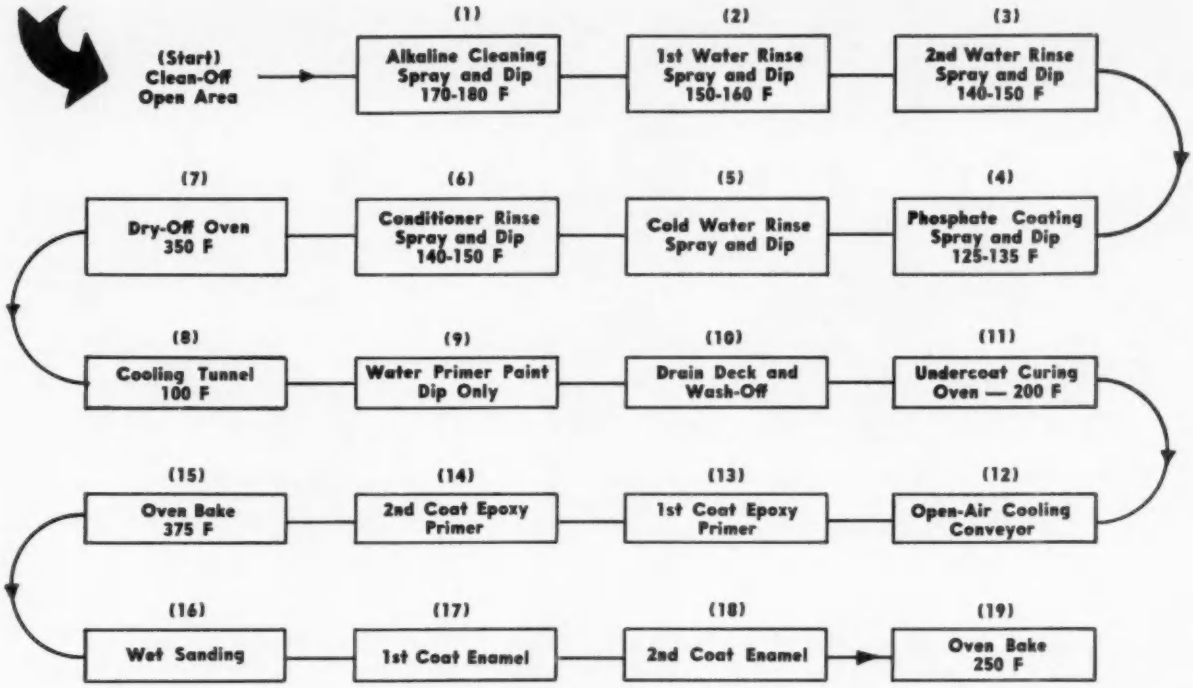
By Charles A. Weinert
EASTERN EDITOR

MAJOR innovations in body finish and final assembly procedures have accompanied Chrysler Corporation's adoption of "Unibody" construction for its 1960 Valiant, Plymouth, Dodge, DeSoto, and Chrysler lines.

As is widely known at this date, the new models have a unitized body from the firewall on back, in combination with a separate bolted-on stub frame at the front end. Chrysler's particular design is therefore different than on any other American make—and, in many respects, Chrysler's assembly techniques are likewise different than those employed elsewhere.

In addition, and coincident with the production of 1960 models, Chrysler incorporated an extensive, and also quite different, rust-proofing system into its vast body-building operations.

Typical of the Corporation's far-flung operations is the Chrysler Delaware Assembly Plant at Newark, Del. This plant assembles Plymouth, Dodge, and Dodge Dart automobiles—from body stampings to completion—at the rate of one



BLOCK DIAGRAM OF OPERATIONS—CHRYSLER RUST-PROOFING SYSTEM

car per minute. It is a big plant, the car assembly portion consisting of a single-story building, all under one roof, with more than 1½ million square feet of floor space.

The purpose of this article will be to describe both the new body finish and the new final assembly procedures for the 1960 Chrysler lines, using the Delaware Plant as illustrative of the practices followed by all of the Corporation's assembly plants except Imperial.

Body Finishing

For this year's models, Chrysler has gone all-out to provide the ultimate in corrosion resistance. More than $18 million was spent on installations of the new multi-stage rust-proofing system in various Chrysler assembly plants throughout the country. In application of the process, each body is given seven dip operations along with six spray operations, followed by seven exterior paint-finishing operations. The system is electronically-controlled, and is fully conveyorized from start to completion of work.

The rust-proofing process really begins when the steel is delivered in coils and sheets from the mills. Before fabrication, the raw steel is "scrubbed" by three spray baths of caustic metal cleaner at 180°F. Then a special drawing compound, developed for the Chrysler system, is applied to the steel as it moves into the blanking and stamping presses. While the stampings are made elsewhere and shipped to the assembly plant, this coating is retained on the surfaces of the material right through body-building operations.

After the body has been assembled by welding, it is carried by an overhead conveyor to a preparation area just ahead of the "anti-corrosion" processing equipment. Here the heavy dirt and grease are roughly hand-cleaned off the exterior parts of the body before it enters the automatic equipment.

The "anti-corrosion" setup, which is about 2400 ft long, is fitted with a continuous "roller-coaster" conveyor, and has seven dip tanks ranging in length from 24 to 69 ft. It also has two ovens and one cooling tunnel.

The "anti-corrosion" cycle alone takes about three hours. Consequently, at the completion rate of 60 cars per hour, more than 170 bodies are in various stages of process at one time.

In the first stage, the bottom of the body is immersed to a depth of 18 in. in a tank of alkaline cleaner. At the same time, overhead alkaline sprays clean the top and sides of the body. This cleaning is done at solution temperatures of 170 to 180° F and for a duration of three minutes. Then the controls start the conveyor, the sprays stop, and the body rises out of the bath. While the next body is going into the bath, the first one gets a 50-sec drain period.

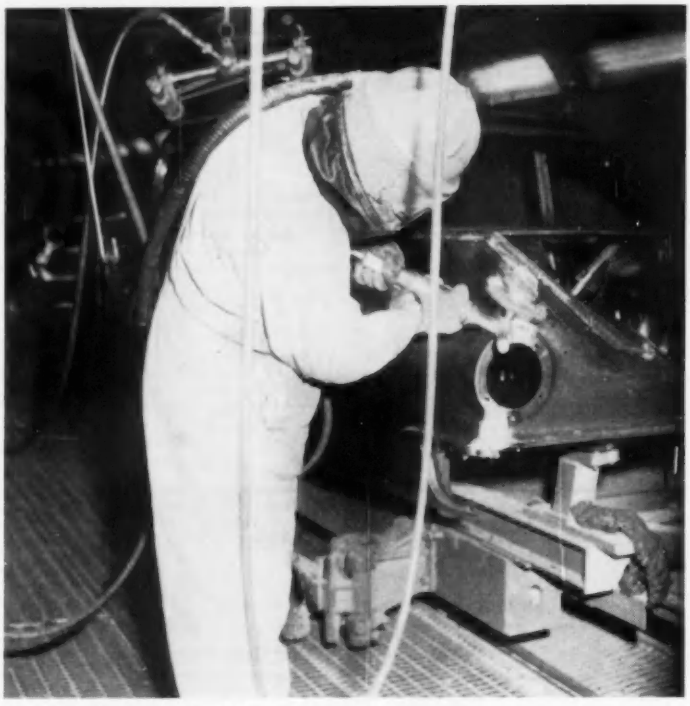
Second stage is a 30-sec clear water rinse at 150 to 160°F; and third stage is another clear water rinse at 140 to 150°F—by dipping and spraying.

In the fourth stage the body is again immersed 18 in. and sprayed from above, this time using a phosphate coating material. Timing is

(*Turn to page* 112, *please*)

Metal Finishing in the Body-Building Plant

PART I



Cutting down solder joint on difficult contour using a shaped resin sanding disk and flexible back-up pad.

By Joseph R. O'Neil

Manager, Development Department, Technical Branch
Coated Abrasives Division, The Carborundum Co.
Niagara Falls, N. Y.

THE past model years have focused attention on all operating costs, and have resulted in some automotive plants making remarkable strides in reducing coated abrasive cost-per-unit. Even during periods of increased production, however, proper control of coated abrasive usage remains an important job for production and cost personnel. This increased production magnifies the savings which can be made through further reductions in unit cost.

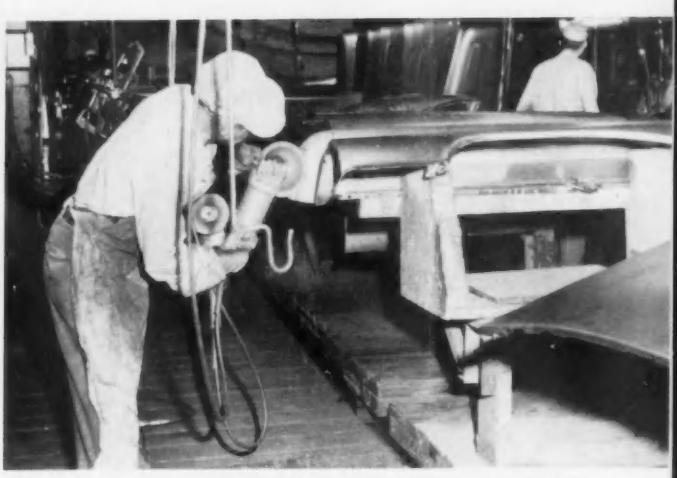
As all of the personnel concerned well know, one of the primary requisites for reducing abrasive costs is an effective way of measuring these costs. Most body plants now have the mechanism for effective control, usually including a cost specialist for consumable items such as coated abrasives. The varying effectiveness with which this control works can be reflected in the varying costs for identical sanding operations at different plant locations. These cost variations are sometimes laid, and rightly so, to factors other than the diligence with which the cost programs are applied. But it is still a fact that the locations displaying the closest cooperation between production and cost personnel normally display the lowest coated abrasive cost-per-job.

The body-build area is presented with a certain number of sanding jobs to do, dictated by the condition of the metal supplied, the construction of the body itself, and the quality necessary when the body moves to the paint areas. It is impossible to completely rectify, during the following operations, a poor sanding job in body-build; these mistakes stay in the body and are passed along for the potential customer to see. So it is up to the body line personnel to correctly select and apply the coated abrasive products and techniques which will successfully do the job —at the lowest cost.

The coated abrasive products available for use on the body line fall into two general categories, the so-called resin bond and glue bond sandpapers. The resin bond products, which employ a cured resin similar to a plastic for bonding the abrasive grain to the backing, in general last longer and produce a faster, more aggressive cutting action than glue bond abrasives. The glue bond items offer the advantages of producing a slightly finer finish than resin bond, and of lower initial cost. Sanding disks, belts, and sleeves are available in both of these types of bond. In addition, the cloth-backed coated abrasives used for belts and sleeves are available with a combination resin and glue bond. In characteristics, this material falls between the straight resin bond and glue bond products, and has certain properties making it useful for solder sanding.

The first step in stretching your coated abrasive dollar is to store and handle the abrasives properly. All of the coated abrasives used on the body line are affected adversely by changes in moisture content. Care should be taken in central stores to keep the abrasives in a dry place, away from any source of heat. The stocks should also be turned over properly, always issuing material for use which has been on the shelves the longest.

Finishing a soldered joint using coated abrasive cloth with a contoured hand block.



Flat sanding on hood and fender line using a resin sanding disk.

When the items are issued for use, the original package is opened and the abrasives are free to pick up or lose moisture, depending on the atmospheric conditions. The most common condition, particularly in the summertime and in humid areas, is for the coated abrasive to absorb moisture. This almost always results in a loss of abrasive life. Glue bond items have a bonding agent which is water-soluble, and excess moisture will actually soften the bond. Resin bond products are more stable, but resin sanding disks, in particular, will warp either toward or away from the grain side, depending on whether the fibre backing gains or loses moisture. This moisture variation is the basic cause for disk warpage, or cupping, which most production personnel have seen at one time or another. The abrasive manufacturers have made considerable improvements toward providing more stable products, but care still is required if all the potential abrasive life is to be obtained.

A simple and highly effective way of helping to insure that top abrasive life will be obtained is to provide coated abrasive storage cabinets on the line, each containing an electric light bulb. This arrangement will provide sufficient heat and low relative humidity inside the cabinets to keep the coated abrasives near their proper moisture content. Usually two or three stations where coated abrasives are normally kept on the line can be combined into one storage cabinet without undue trouble for the foremen involved. This inexpensive and widely-used storage method can produce real returns in reduced abrasive costs.

While coated abrasives should ideally be stored under controlled conditions of approximately 70 F and 50 per cent relative humidity, the capital expenditure and operating costs involved make this approach unattractive to most plants. Instead, proper inventory

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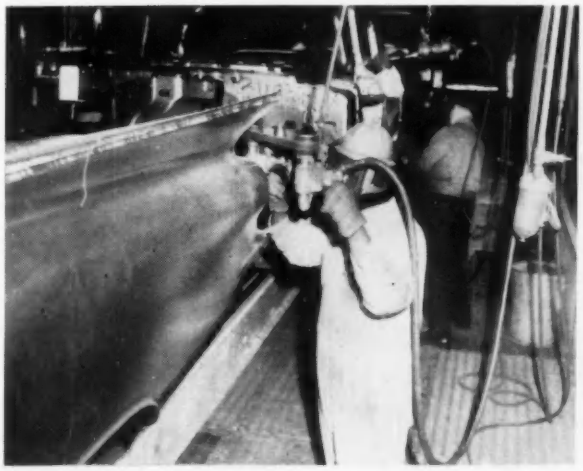
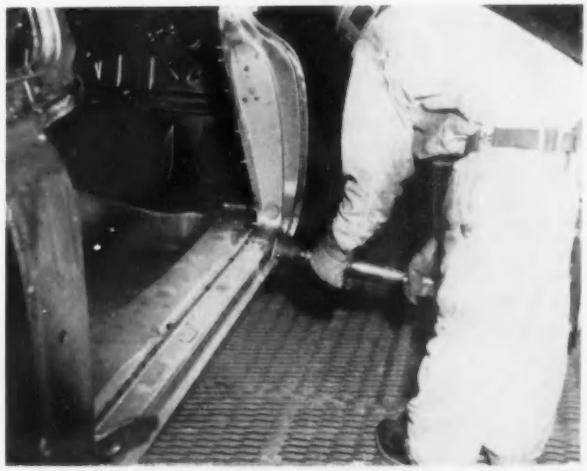


Blending in solder on extreme contour using slack of belt.



Cutting down soldered joint using abrasive sleeve and expanding slotted drum.

How Preventive Maintenance Improves Quality in a Modern Foundry

Pontiac's Engine Block Line Has Turned Out 220 Units per Hour With Rejects Held at 0.2 Per Cent

By Charles A. Weinert, Eastern Editor
IN COOPERATION WITH
Norris Luther, Assistant Plant Engineer
Pontiac Foundry Division, Pontiac Motor, Pontiac Mich.

A THOROUGH program of preventive maintenance is paying handsome production and quality dividends on the mechanical engine block line at the Pontiac Foundry in Pontiac, Mich.

Original production was hampered by many problems, allowing a peaking of 125 blocks per hour. The line is now averaging substantially better hourly production over what it formerly peaked and is now peaking at figures as high as 210-220 per hour. Scrap due to mechanical failure on the line has been reduced to 0.2 per cent.

The program was set up and is under the supervision of the foundry's plant engineering department. Pontiac plant engineers work in close cooperation on machinery design changes which affect preventive maintenance with engineers from Osborn Manufacturing Co., Cleveland, Ohio. Osborn designed, built and installed the engine block line for Pontiac in 1954.

Preventive maintenance in the Pontiac foundry involves three basic approaches: modification of existing components, design of new components and developments of new methods which will eliminate trouble spots or simplify present operations. It affects all parts of the line, including mold making, shake-out and close machines, flask handling, sand distribution, sand collection and treatment, power sources and electrical system and controls.

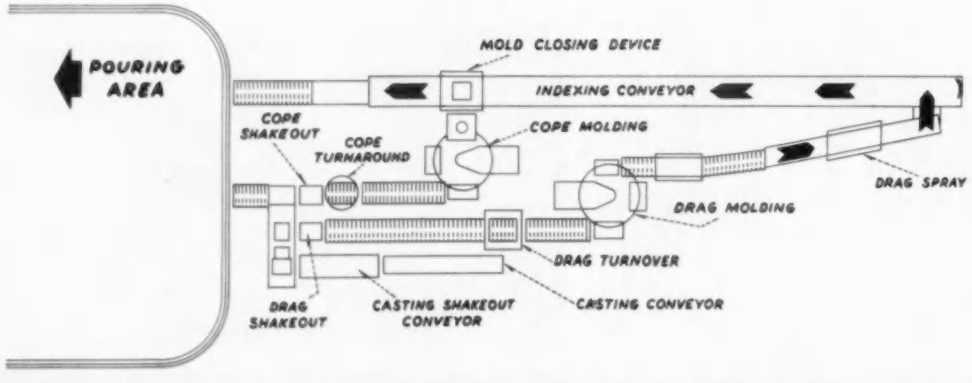
At Pontiac, a total of five men are assigned to preventive maintenance on Line No. 1. Most of their work is performed during shutdown hours on the third shift.

Line No. 1 performs a complete molding cycle (Fig. 1) from the time sand enters the molding machine to the entrance of the closed mold into the pouring and cooling zone. After cooling, the unit completes the cycle by stripping the cope from the drag, shaking out the sand and engine block casting, and returning empty flasks to the molding unit.

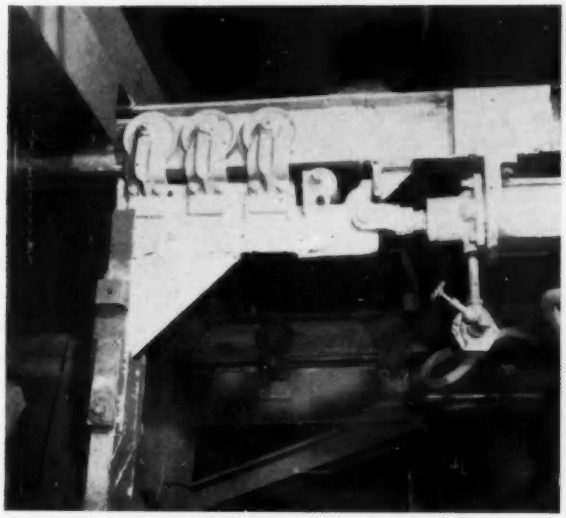
Electrical controls govern the pneumatic and hydraulic cylinders which actuate the line. All handling equipment is so constructed that flasks move in multiples of one length. A master panel controls all phases of the automatic system.

Basic automatic equipment in the line includes two four-station Osborn molding machines (one for cope, one for drag), a stripper, two jolt shake-out machines, and a close machine.

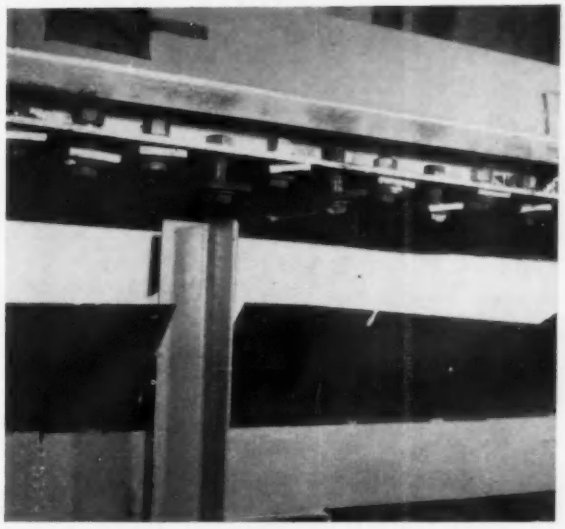
A major problem in any modern foundry is the control system. In Line No. 1, a fully loaded flask weighs upwards of 1500 lb, and must be moved in short cycle time



Block diagram of Pontiac Foundry Line No. 1, showing changes made in thorough-going preventive maintenance program.



Rigid trolleys support the cylinder arms in motion preventing misalignment of cylinder arms in the extended position.



Alternating the angles on sand cutter bars both on return sand and prepared sand has eliminated clogging of sand lumps between bars.

to and from work stations. Movement is controlled by a series of relays, contact points and limit switches. These mechanisms are constantly exposed to loose sand.

At Pontiac, sand was filtering into control and junction boxes and fouling contacts. Covered contacts can mean a missed cycle, possibly a jam-up of flasks at the next station. Small compressed air lines were run into control and junction boxes. Pressure inside the box is kept at 2 to 4 psig air pressure, imposing an "air shield" around the contacts.

Pressurizing control boxes, however, did not solve the entire problem. Metal to metal contacts are widely used because of simplicity, compactness and economy. Foundry dust, however, is likely to produce contact contamination.

The use of 110 volts for control circuits, while being desirable for safety reasons, is below the critical sparking voltage for small air gaps, and contacts may occasionally fail to conduct current. This means shutting down to locate the contact and cleaning it. The job of cleaning contacts became a daily and time consuming task.

The Allen Bradley Co. engineers developed a static "Peaker," which superimposes a substantial voltage pulse in the control circuit at the peaks of each cyle, 120 times a second. These pulses search out any closed contacts that might be separated slightly due to contamination and produce an arc to start conduction which is maintained by the 110 volt control circuit.

The pulses are of such small energy content that they offer no increase in danger to personnel above the shock to be experienced from an "unpeaked" 110 volt control circuit.

Another problem involving both electrical control and materials handling, was the destruction of limit switches. As originally installed, limit switches were right on the line of movement. As flasks

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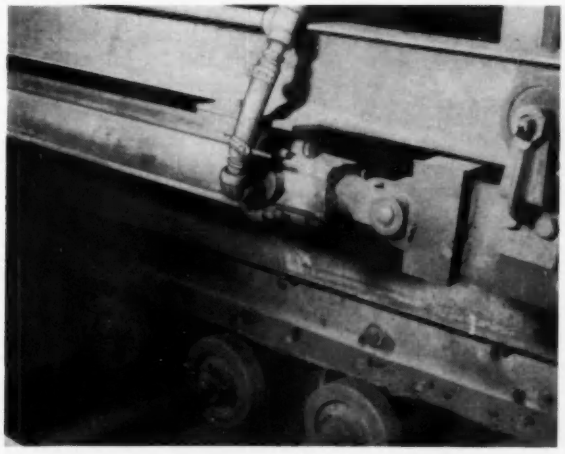
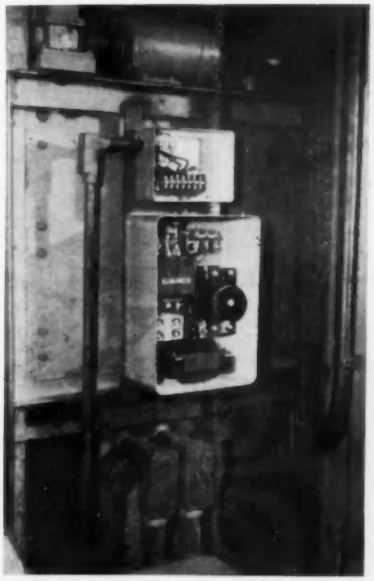
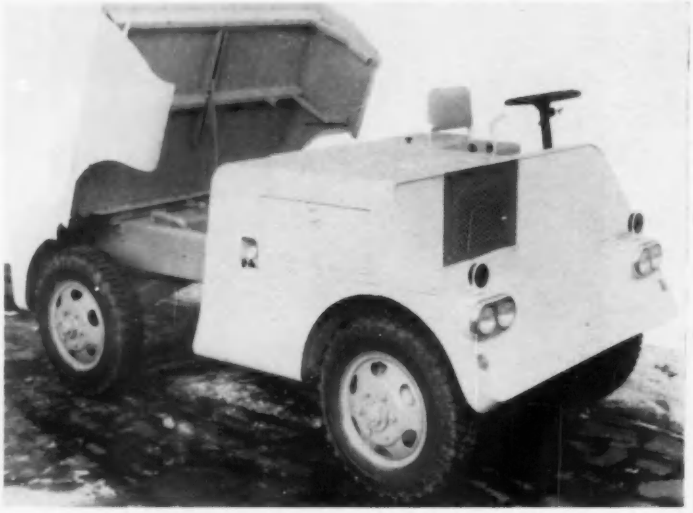


Vibration - caused breakage of pipe on air system is eliminated by installation of 6" of rubber hosing at the junction point.



The static "Peaker" shown (right) superimposes a substantial voltage pulse in the control circuit 120 times a second. This eliminates difficulties caused by contact separation due to contamination.

With backhoe and hydraulic hammer, the commando forms a versatile tool



The Commando, basic unit of the line

Versatile New Vehicle

A NEW BASIC prime mover, the Commando, is now in production at the Ottawa Steel Div. of Young Spring and Wire Corp. at Ottawa, Kansas. It is powered by a Continental 4-cylinder engine of 162 cu in. piston displacement or by a Continental 6-cylinder engine with a piston displacement of 244 cu in. Both engines have a governed speed of 2400 rpm.

Wheelbase of the vehicle is approximately 109 in., and it is available with two-wheel or four-wheel drive and with two-wheel or four-wheel steering. Other options are power steering, and an Allison torque converter in place of the conventional drive. The basic unit weighs about 9200 lbs.

A number of attachments are available for use with the Commando such as a backhoe and a hydraulic hammer. Another attachment is an adjustable fifth wheel which permits the vehicle to be backed under a trailer to raise it and move it with a minimum amount of maneuvering. Still other attachments are a snow plow and a sweeper, with others being readied for introduction at an early date. ■

SAE Annual Meeting

(*Continued from page* 63)

indicated the performance of such a machine, with respect to cruising and hovering capabilities, depends primarily on the ratio of its size to its operating height. And that the rougher the surface over which the vehicle must travel, the greater must be the cushion of air and the larger must be the size of vehicle if satisfactory performance is to be obtained. He concluded that operation at "reasonable" heights appears feasible in two classes of vehicles—moderate-size operating at heights of about one foot over flat unobstructed land or marsh, inland rivers, and small lakes; and large machines operating at heights on the order of 10 ft over large bodies of water.

ENGINEERING DISPLAY

The SAE Engineering Display was another major feature of the meeting program. More than 70 companies (listed separately) exhibited latest development in automotive components, materials, and material applications. Competent representatives manned the booths to answer inquiries and discuss technical aspects with those in attendance. Typical examples of the many new products which were on view at this exhibit are the following:

Engines: Continental Motors Corp.—Multi-fuel six-cylinder engine for M35 2½-ton military truck; Model J69-T-25 turbojet engine with a military thrust rating of 1025 lb; and Model AU75-R single-cylinder four-stroke 7.43-cu in. aircooled midget racing engine. Hercules Motors Corp.—New three, four, six and eight-cylinder automotive Diesels, both naturally-aspirated and turbocharged; including the D-662 V-8 polyfuel engine rated 265 hp at 2600 rpm when turbocharged and having a weight with aluminum heads and block of 1450 lb. Waukesha Motor Co.—Roiline H570 gasoline engine, rated 238 hp at

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Spline Rolling of Tractor Axle Shafts

Ford Adapts High-Speed Process To Job-Lot Runs in Highland Park, Mich., Plant

FIRST tractor manufacturer to adopt cold roll-forming to producing splines on axle shafts, and one of the first companies to adapt the Michigan Roto-Flo process to the production of different parts in job lots on a single machine, the Tractor and Implement Division of Ford Motor Company reports the following results: (1) Much stronger shafts, with greatly reduced chance of shaft breakage; (2) More uniformity as to size; (3) Better surface finish of splines, resulting in maintenance of minimum backlash in service; (4) Improved grain structure; (5) Reduced manufacturing time; and (6) Major savings in manufacturing and tool cost.

A single Michigan Roto-Flo Model 1551 machine is used to produce all the spilnes on the ends of two sizes of axle shafts for Ford tractors manufactured in the Highland Park (Michigan) plant. Cycle time per axle shaft is less than 30 seconds. Since the production quantity required is well below the capacity of the machine (150 per hour), the operation can be and is performed in the "free" time of a grinder hand.

The operation consists of inserting the shaft between centers and pressing a button. The centers shuttle the shaft into place; the two racks (upper and lower) of the machine produce the spline in a single opposed stroke; then the shafts shuttle out and are unloaded.

To insure uniformity, the shafts ends are held to 0.001 in. for OD and 0.0005 in. for taper in the grinding operation ahead of the spline-rolling. During the rolling operation the flow of the metal creates a maximum diameter approximately 0.050 in. greater than pre-roll blank diameter.

Output is approximately 540 axle shafts per day for the two shaft sizes combined. However the ratio of small to larger shafts varies quite a bit from day to day according to demand. To change from one size to another in production, the corresponding racks are simply interchanged. Changeover is facilitated by the use of accurately-ground 0.050-in. thick spacers under the racks for the shaft with the smaller OD. No machine throat depth adjustments are, therefore, necessary when changing from one OD to the other. Changeover time is about 1½ hours.

Since the operation has been put into effect, some 125,000 shafts have been produced on the one machine and with the same two sets of racks. So far no measurable rack wear has been detectable.

With the Roto-Flo process, a fine finish is obtained resulting in better maintenance of backlash in service. Also contributing to de-

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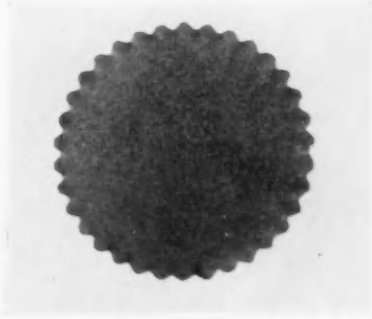
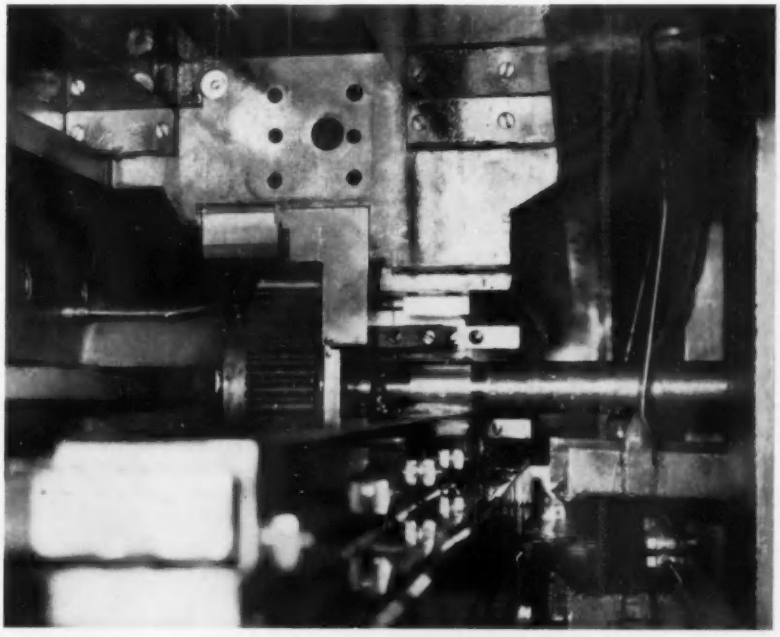


Etched cross-section of cold-rolled spline



Ford Tractor rear axle shaft in process of being spline-rolled by the Michigan Tool Co. Roto-Flo method

Report from the FARM EQUIPMENT INDUSTRY

New Model 1900 tractor, Oliver's largest

By Kenneth Rose

FARM equipment manufacturers are entering the new decade with hundreds of new items of farm machinery and improvements on present machines to provide the farmer with equipment of higher speed, greater productive capacity, and greater convenience. Deere & Co. announced that it has 64 new features for 1960. Oliver Corp. has announced that it has 80 new and improved items in its line, to be available during the coming year. International Harvester Co. states that, in addition to the line of new tractors announced last year, it will have about 54 pieces of new equipment for 1960 agricultural machinery market. Allis-Chalmers will introduce 72 items in its agricultural equipment line. J. I. Case will step up the power in its line of tractors, and introduce new equipment for other operations.

Three new models in its line of farm tractors ranging in horsepower rating from 25 to 90 have been announced by Oliver Corp. Two heavy duty tractors, Models 1800 and 1900, will be produced at Oliver's Charles City, Ia., plant, and a third, Model, 500, will be built in England to Oliver specifications. Model 1800 is powered with an Oliver 6-cylinder gasoline, Diesel, or LP gas engine developing approximately 73 hp at the power take-off. The gasoline engine has 265 cu in. displacement, and the Diesel 283 cu in. Both are governed at 2000 rpm. Model 1900 is powered with a 4-cylinder 2-cycle Diesel engine of 212 cu in. displacement, developing an estimated 92 hp at the power take-off at governed speed of 2000 rpm. Both the 1800 and the 1900 models are equipped with helical gear transmissions, and a power shift underdrive provides either 30 or 50 per cent speed reduction. Speeds range from 1½ mph to 16 mph. In the 500 model, the power plant is a 4-cylinder, valve-in-head, 32 hp engine with wet cylinder liners, 154 cu in. displacement, and are available in a choice of gasoline or Diesel types. Governed at 2000 rpm, it has a speed range of 2.1 to 14.2 mph forward and 3.45 to 7.72 mph in reverse.

These models are to be produced in several agricultural configurations, with dual, adjustable, or single-wheel front ends. Both high-power models can be purchased with a wide assortment of optional equipment.

National Distribution for Harvester Diesel

International Harvester Co. announced that the small Diesel powered farm tractor introduced in the Southeast last summer will be distributed nationally. The 4-cylinder

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Oliver's new small Diesel tractor

Model 1800 Oliver tractor

News of the MACHINERY INDUSTRIES

Latest NMTBA Statistics, While Still Not Yet Finalized, Indicate 1959 Machine-Tool Net New Orders Totaled Close to $660 Million, Compared to 1958's $374.3 Million

By Charles A. Weinert

Machine Tool Sales Favorable at Year-End

In the closing month of 1959, shipments of machine tools reached the high for the year with an estimated $63.7 million—while net new orders at $58.8 million maintained the average monthly volume of 2nd Half, 1959.

Latest statistics released by the National Machine Tool Builders' Association are still preliminary for the month of December and, to that extent, also for the Year 1959—but here are the indicated results:

During December, net new orders for metal-cutting machines amounted to an estimated $46.05 million. Metal-forming machines had an order volume of $12.75 million. In November 1959 the respective figures were $41.95 and $12.3 million, for a finalized total of $54.25 million. A year previously, in December 1958, net new orders were $31.05 and $12.85 million, for a total of $43.9 million.

With the data now available, net new orders for the full Year 1959 are:

Metal-Cutting	**..$509.40 million**
Metal-Forming	**..$150.05 million**
1959 Orders	**..$659.45 million**

In 1958, net new orders for both types of machines totaled $374.3 million. In 1957 the volume was $642.9 million.

On shipments, December's preliminary $63.7 million substantially exceeded the volume in any other 1959 month.

Metal-cutting machine shipments in December are estimated at $51.65 million. The prior metal-cutting top 1959 month was October, with a volume of $40.2 million.

Forming-type machine shipments in December amounted to a preliminary $12.05 million — better than the monthly average for the year, but under June's $12.9 million and November's $12.4 million.

Taking both types combined, December's $63.7 million exceeded the prior-high 1959 month (October, when shipments amounted to $51.5 million) by $12.2 million. It also can be compared with December 1958 shipments of only $43.95 million.

For the year 1959, total shipments now stand:

Metal-Cutting	**..$413.65 million**
Metal-Forming	**..$124.35 million**
1959 Shipments	**.$538.00 million**

In 1958 shipments of both types of machines totaled $519.9 million, including $411 million of metal-cutting machines. In 1957, total shipments amounted to $1088.3 million.

Backlogs of orders on hand as of January 1, 1960, are currently estimated at 4.8 months for metal-cutting machines and 4.7 months for metal-forming machines.

This new Buhr Economatic transfer machine, developed for machining an automatic transmission case, performs 120 drilling, milling, reaming, spot-facing, chamfering, and tapping operations — and also does two automatic assembly operations. A big machine, only partially shown in this close-up view, it is about 164 ft in length, has 67 stations, and is equipped with 66 electric motors. Production output, handling a wide variety of operations, is at the rate of 180 pieces per hour.

Transfer Unit Developed for Transmission Cases

One of the latest pieces of equipment developed for use in the Detroit area is a Buhr Economatic transfer machine which has a length of about 164 ft and 67 stations. It was designed for machining an automatic transmission case.

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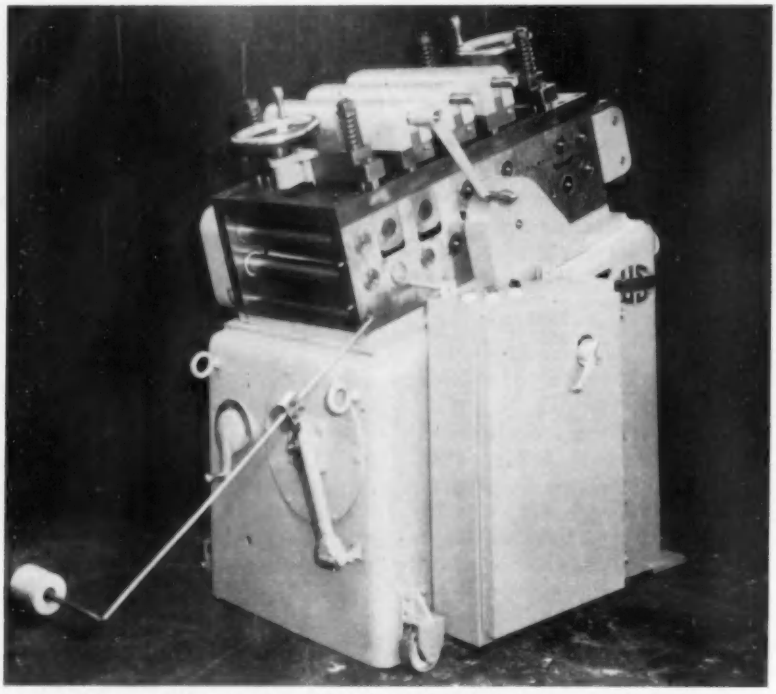
NEW PRODUCTION and PLANT EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card at back of issue



Straightening machine handles cold or hot rolled steel, brass, copper or aluminum

Power Driven Rollers Straighten Stock Up To 16 In.

A NEW metal straightener is arranged with a pair of take in rollers, six straightening rolls and a pair of take out rollers. The top three straightener rollers are individually adjustable, while the bottom three are power driven. This machine has a capacity of handling material up to 16 in. wide and ¼ in. thick. Equipped with casters for portability it also has a five hp variable speed drive unit with outputs from 10 to 50 fpm. *U. S. Tool Co., Inc.*

Circle 41 on postcard for more data

Precision Welder

A NEW shielded-arc welder designed for precision welding applications is now available. The welder, designated the VTW-14, may be used with any of the inert-gas, shielded-arc welding heads now available. It can be used either manually or in automatic machines to precision weld thin metal parts such as metal bellows, stainless steel tubing, electron tube components, or instrument parts. The welder will handle both ferrous and non-ferrous alloys from approximately 0.001 to 0.025 in. in thickness and is designed to operate on a continuous production line basis.

The VTW-14 has a continuously adjustable welding current range, varying from 0.25 to 25 amp. A saturable reactor with high capacity chokes is used to obtain this stepless adjustment. The reactor circuit also eliminates any voltage increases at low current levels. The DC output is therefore extremely smooth, resulting in clean, even welds, even with the most delicate materials.

This welder gives the operator a choice of methods for starting the arc. A built-in RF oscillator-type starter can be set to remain on continuously during welding, or it can be set to start the weld and shut off automatically when the DC has begun to flow. A break in the DC arc will then turn the RF on again, a feature especially useful in automatic machine-type operations. The user also may start the arc conventionally by touching the electrode to the workpiece.

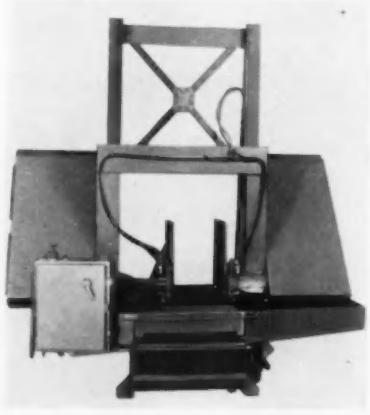
The VTW-14 is available in a cabinet model measuring 23 by 15 by 22 in. for use on a work table. For mobile applications, the welder comes mounted on a two-wheeled cart with push-bar and holder for the welding handpiece. *Vacuum Tube Products Div., Hughes Aircraft Co.*

Circle 42 on postcard for more data

Horizontal Band Saw

DESIGNATED the BP-1, a new band saw is reportedly capable of cutting a 21 in. round aluminum billet in 10 minutes.

The machine is 107 in. high, 101 in. side to side, and 60 in. front to back. It features variable speed drive from



Bandsaw designed for production

45 to 1200 FPM with a 5 HP drive motor. Blade size is 22 ft. 1 in. x 1¼ in. x .042 in. Cutting capacity is 24 in. wide x 36 in. high.

Blade wheel doors are interlocked with the electrical system so that opening the doors automatically shuts off the machine. *W. F. Wells and Sons, Inc.*

Circle 43 on postcard for more data

Portable X-Ray Unit

A NEW industrial X-ray unit is said to produce high penetrating power for radiographic applications.

High power portable X-ray unit

Completely self-contained, the new unit is shockproofed, rayproofed and weatherproofed for outdoor operation. Safety devices effectively prevent overload on the tube. Tubehead weighs 231 lbs and may be hoisted to remote areas for radiography of more than three inches of steel.

Emergent beam angle is 40 deg and focal spot size is 2.3 mm. X-ray voltage is continuously adjustable under load in a stepless range from 65 to 300 kv. Load rating is 5 ma up to 260 kv, and 4 ma from 260 to 300 kv. Duty cycle is 100 pct continuous with water cooling—intermittent with air. *Philips Electronic Instruments.*

Circle 44 on postcard for more data

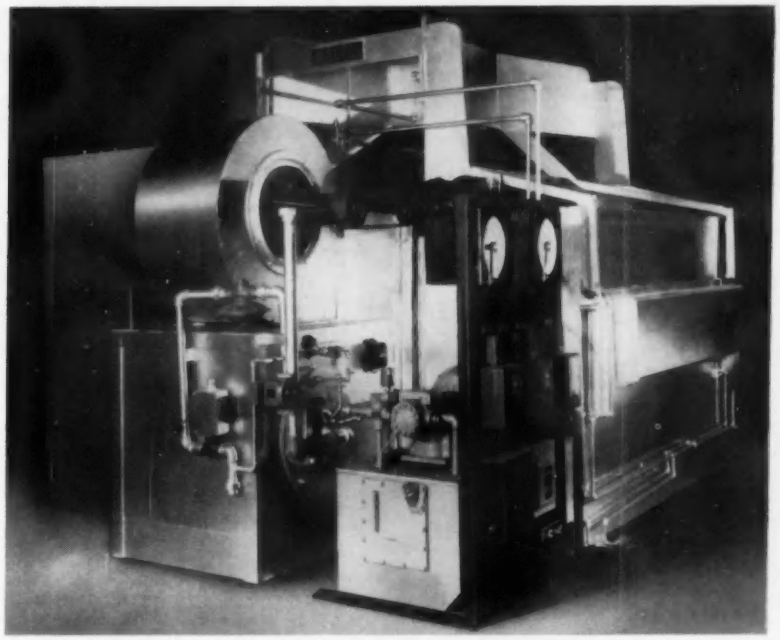
Numerically Controlled Press

A new numerical control system that has been developed for a high speed punch press, is said to feature a high degree of flexibility and simple programming. This system has built in logical decision making elements that are said to be similar to those found in electronic computers.

The press punches holes of various sizes and shapes in linear bar stock and cuts finished pieces to the desired length. Information entered on a punched paper tape tells the system the size of the desired piece and the number, type and location of the holes. The system, through internal logic, determines the sequence of operations. Only the part specifications are entered on the tape.

In announcing this new control development Isaac L. Auerbach, President of *Auerbach Electronics Corporation*, cited this unit as the first of a new line. The new line of controls will be applied to various types of machine tools.

Circle 45 on postcard for more data



Furnace features doors that open in both the front and back for use at each end

Circle 46 on postcard for more data

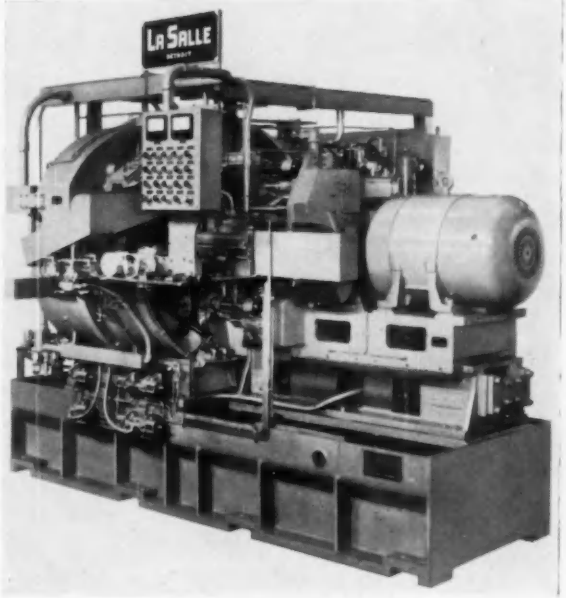
Steel Sheets Flattened During Heat Treat Process

FLATTENING of steel sheets, and heat treating at the same time, is accomplished by two dies located inside this furnace. The top die is mounted to a hydraulic cylinder with a ball joint while the bottom one is stationary. Pressure is supplied to this cylinder by a *Vickers* hydraulic unit. It is said this furnace can handle material such as 17-7PH in sizes up to 74 by 100 in. Temperatures can be held to ± 5 deg F, in a range of 250 to 1100 deg F. This furnace is of the circulating type and is available as a gas fired, or electrically heated unit. *Waltz Furnace Co.*

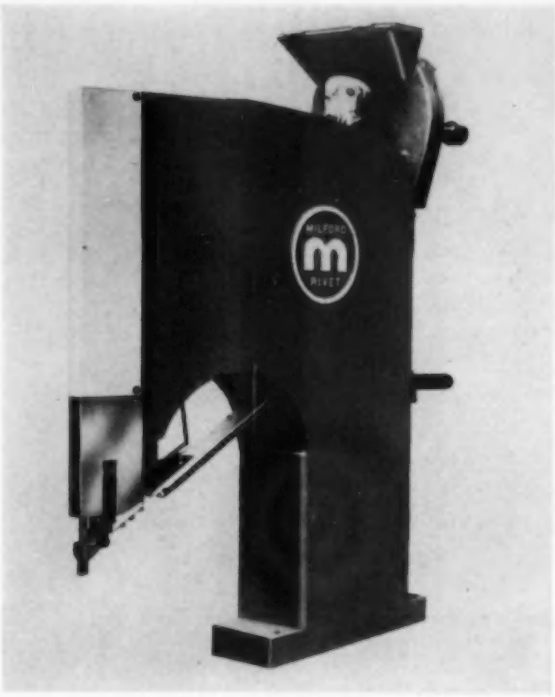
Six Station Trunnion Type Machine for Pistons

This new machine tool, designated the LaSalle Pistonette, has been designed specifically for machining truck, bus and heavy equipment pistons. It is said this machine can handle three different pistons at one time, and automatically loads and unloads each unit. All seven spindles in the drill head are hardened and ground. Other features of this tool include automatic lubrication, electrical control panel with push button assembly and compact size. LaSalle Machine Tool, Inc.

Circle 47 on postcard for more data



Heavy Duty Model For Multi-Head Pneumatic Riveting



This addition to Milford's expanding line of pneumatic riveters is fabricated of steel to combine minimum weight and overall dimensions with maximum strength and durability. Although the new unit offers a 3 in. stroke and 12 in. throat depth, its overall size has been held to 33 in. high by 23¼ in. deep. The tapered nose construction and narrow, 5 in. wide cross section permit setting rivets on varying centers down to 1 in. Through the use of offset spindles, two heads may be opposed to further reduce center distances. Air pressure regulator, oil-mist lubricator, air cleaner and exhaust muffler are available as optional accessories.

Circle 48 on postcard for more data

A NEW, compact, pneumatic rivet machine, for heavy-duty applications, is said to be especially suited to multi-head or "cluster" installations. The model 57 sets semi-tubular, full tubular or bifurcated rivets ranging from ⅛ in. diam by ⅛ in. long to 3/16 in. diam by 1 in. long.

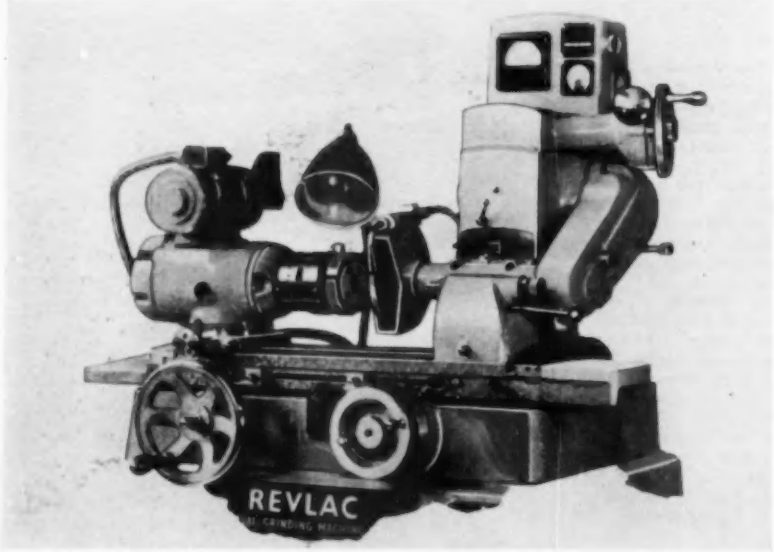
Several model 57 heads may be grouped on a single base and combined with slide fixtures or transfer tables, as one production unit adaptable to automatic cycling. Actuated by pneumatically driven toggle linkage, operating on 60 to 150 psi shop air pressure, maximum cycling speed is governed only by the rate at which rivets feed into the jaws. Stroke speed is readily adjustable to control impact when fragile materials, such as plastics or ceramics, are being assembled. The model 57 is connected directly to a shop air outlet when used individually on bench or pedestal mounts when used in multiples, the heads are connected to a common manifold. *The Milford Rivet and Machine Co.*

Three Way Grinder for Internal-External and Surface Grinding Operations

A SMALL grinding machine, manufactured in England, is now offered to American industry. It is known as the Revlac Trigrinder and was designed for three types of grinding.

To change from chucking or face plate work to work on centers requires swinging the work head around through 180 deg.

Changeover for internal grinding involves the mounting of the proper quill, and conversion for surface grinding requires the swivelling of the wheel head through 90 deg and mounting the appropriate magnetic chuck or holding fixture.



Grinder has fine feed of .00005 in. per division on the cross feed

Speed changes of both work head and grinding head, variable throughout the entire speed range, are made by rheostat . . . with input current to be whatever is available. The AC to DC conversion unit is in the machine.

Both spindles have a visual, nonmechanical indicating dial showing the exact speed of each. The grinding spindle has a speed capacity in excess of 40,000 rpm. Bearings are self-adjusting and allow for thermal diametral and linear expansion.

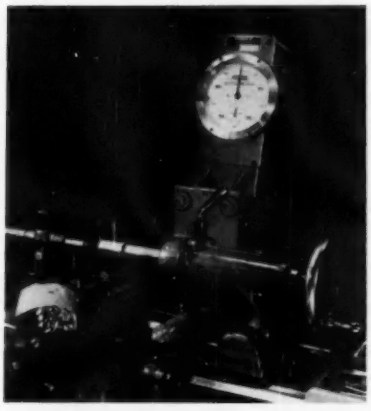
Down feed for surface grinding operations has both coarse and fine settings. The fine feed is in increments of 0.0001. Finishes as fine as one micro in. are obtainable. The table movement is fitted with micrometer stops and table inclination can be set within 15 seconds of arc. Workpieces up to nine in. between centers may be ground. *Russell Holbrooke and Henderson, Inc.*

Circle 49 on postcard for more data

Compression Testing

INTERCHANGEABLE "load cells" are featured in the model LPT testing machine. Designed to perform all manner of tensile and compression strength tests within its relatively low load capabilities, it allows the use of four different load cells, each providing a different maximum load; 100, 200, 600, and 1000 lb.

The 115-volt electric motor-powered hydraulically operating mechanism produces an operation from 0 to 1000



Instrument features push button zeroing

lb per second and is completely independent of the load measurement system. Two controls are provided, one to start, direction, and stop the ram movement, one to select ram speed. Tensile test specimens up to 3/16 in. thick, 1 in. wide, and 12 in. long and compression test specimens up to 4 in. dia. and 6 in. high can be accommodated. *Detroit Testing Machine Co.*

Circle 50 on postcard for more data

Multi Hole Punches

IN a new line of adjustable punches and dies, called Di-Acro, the basic elements are specially designed die sets on which punch and die holders can be arranged—by means of a template—into a variety of hole patterns. This adjustable punch and die program can be used for both long and short run production jobs. It has best application, according to the manufacturer, where multiple holes are to be punched on a short-run basis because it saves the time and money involved in punching or drilling holes individually or in having a permanent die made up. Material as thick as 16 gauge mild steel and ⅛ in. aluminum can be punched to tolerances of ±0.005 in. *O'Neil-Irwin Mfg. Co.*

Circle 51 on postcard for more data

More Government Contract Awards

LATEST contracts awarded by various Government agencies, and covering primarily automotive and aviation products, are listed in the following. Typical of the items contained in these monthly listings are: passenger cars, motor trucks, aircraft, military tanks, engines, transmissions, other components, spare parts, plant equipment, etc. This list is for the period Jan. 2nd to Jan. 29th, inclusive.

AIRCRAFT PRODUCTS CO., Bridgeport, Pa.
Spare parts, aircraft—$47,657

AIRE-SEARCH MFG. CO., Los Angeles, Calif.
Nike-Hercules, repair parts—$63,283

AMERICAN MOTORS CORPORATION, SPECIAL PRODUCTS DIV., Detroit, Mich.
Truck, utility—$662,423

ARCOS CORP., Philadelphia, Pa.
Electrodes & Rod Welding—$42,644

AUTOMATIC TRANSPORTATION CO., DIV. YALE & TOWNE MFG. CO., Chicago, Ill.
Truck, fork lift, 11 ea—$49,002

BEECH AIRCRAFT CORPORATION, Wichita, Kan.
Spare parts, aircraft, 5 to 677 ea—$26,198

BENDIX AVIATION CORPORATION, PACIFIC DIV., North Hollywood, Calif.
Spare parts, aircraft, 274 to 703 ea—$47,061

CALCO MACHINERY CO., Philadelphia, Pa.
Engine Lathe, 2 ea—$27,993

CESSNA AIRCRAFT COMPANY, MILITARY AIRCRAFT DIVISION, Wichita, Kan.
Jet trainers—$9,500,000

CHRYSLER CORPORATION, Detroit, Mich.
Jupiter missile system—$899,600

CONSOLIDATED WELDING & ENGINEERING CO., Chicago, Ill.
Truck, stake, 750 ea—$1,063,267

DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif.
Nike-Hercules Launching Equipment—$64,887

THE DAYTON RUBBER CO., Dayton, Ohio
Tire—2840 ea—$32,290

DELAWARE VALLEY MACHINERY, INC., Willow Grove, Pa.
Lathe—3 ea—$28,062

THE ELECTRIC AUTO-LITE CO., Toledo, Ohio
Spark plug, 1,000,000 ea—$449,000

FIRE MASTER CORP., Mt. Clemens, Mich.
Truck, fire-fighting—19 ea—$237,500

GENERAL ELECTRIC CO., ENGINE DEPARTMENT, Cincinnati, Ohio
Turbojet engines (179)—$17,000,000

DETROIT DIESEL ENGINE DIV., GENERAL MOTORS CORP., Detroit, Mich.
Diesel propulsion engine, qty.—29—$168,709

GILFILLIAN BROS., INC., Los Angeles, Calif.
Repair parts, Missile System—$109,942

THE GOODYEAR TIRE & RUBBER CO., Akron, Ohio
Tires, 587 ea—$68,101 (aircraft)

THE FRANK G. HOUGH CO., Libertyville, Ill.
Tractor, aircraft towing and starting, 50 ea—$375,762

THE FRANK G. HOUGH CO., Libertyville, Ill.
Tractor, aircraft, towing, 7 ea—$174,386

INTERNATIONAL HARVESTER CO., Chicago, Ill.
180 Tractors—$3,196,654

JOHNSTON STAINLESS WELDING RODS, INC., Los Angeles, Calif.
Rod Welding—$31,512

KAMAN AIRCRAFT CORPORATION, Bloomfield, Conn.
Helicopters—$14,000,000

PETER KIEWIT SONS COMPANY, Arcadia, Calif.
Missile facility complexes—$30,157,150

LIFT-A-LOFT CO., Muncie, Ind.
Trucks—3 ea—$35,275

MACK TRUCKS, INC., Plainfield, N. J.
Engine Gasoline—$248,772

MARTIN COMPANY, Orlando, Fla.
Pershing missile system—$82,599,690

THE MARTIN CO., Orlando, Fla.
Spare parts, missile, 46 ea—$121,590

MID-STATES WELDER MFG. CO., Chicago, Ill.
1 Welding machine—$37,728

MINNEAPOLIS MOLINE CO., Hopkins, Minn.
Truck, fork-lift, 350 ea—$1,227,368

THE MONARCH MACHINE TOOL CO., Sidney, Ohio
1 Lathe—$32,895

NORTH AMERICAN AVIATION, INC., Canoga Park, Calif.
Rocket engines—$178,500

NORTH AMERICAN PRODS. CORP., Jasper, Ind.
Carbide butting tools, qty. indefinite—est. $30,000

BAKER INDUSTRIAL TRUCKS, DIV. OF OTIS ELEVATOR CO., Cleveland, Ohio
Truck, fork-lift, 7 ea—$33,962

PACIFIC TIRE AND RUBBER CO., Oakland, Calif.
Tire, 11,422 ea—$294,644

RAYTHEON COMPANY, Andover, Mass.
Repair parts, missile system, 503 line items—$334,367

RAYTHEON MANUFACTURING COMPANY, Waltham, Mass.
Hawk missile systems—$42,402,854

RAYTHEON CO., Waltham, Mass.
Repair parts, missile system, $9,531,000

A. O. SMITH CORP., WELDING PRODUCTS DIV., Milwaukee, Wis.
Welder, qty. 26 ea—$98,239

SOLAR AIRCRAFT CO., San Diego, Calif.
Gas turbine engine, 1 ea—$59,488

SPERRY UTAH ENGINEERING LABS., Salt Lake City, Utah
Repair parts, Guided Missile System—$161,000

TOWMOTOR CORP., Cleveland, Ohio
Truck, fork lift, 85 ea—$429,415

FISK TIRES DIV., UNITED STATES RUBBER CO., Detroit, Mich.
Tire, 4920 ea—$56,629

WESTERN ELECTRIC COMPANY, Burlington, N. C.
Nike spare parts and components—$449,270

WESTERN ELECTRIC CO., INC., New York, N. Y.
Nike spare parts, 191 ea—$192,910

WESTERN ELECTRIC COMPANY, Winston-Salem, N. C.
Nike spare parts and components—$52,476

WHITE DIESEL ENGINE DIVISION, WHITE MOTOR COMPANY, Springfield, Ohio
Diesel generator sets, 6—$1,369,800

NEW PRODUCTS AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

Corvair Options

Development of an optional engine with added performance features, an all-new four-speed transmission and a heavy-duty chassis package for the rear-engined Corvair was announced today by Chevrolet.

Principal modifications in the "flat" six-cylinder engine are a special camshaft for greater valve lift and open duration, larger muffler passages and a tailpipe of greater diameter. Listed as a factory installed option, the new power plant is rated at 95 hp as compared to 80 for the standard Corvair engine.

The new four-speed transmission features synchromesh engagement in first, second and third gears. The heavy-duty chassis developments include stiffer springs and shock absorbers, rear suspension rebound straps, front suspension stabilizer bar and sintered iron metallic brake facings. *General Motors Corp.*

Circle 55 on postcard for more data

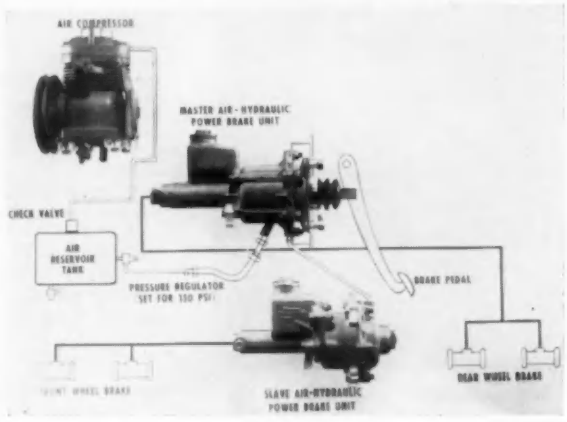
Atomic Fuel Gauge

A new fuel gauge, which utilizes sources of atomic energy in measuring the amount of fuel in aircraft and missiles, has been developed for use by the Navy. This device has been tested at altitudes of 38,000 ft in a twin engine jet bomber.

The atomic materials used in this gauge are those which are sources of gamma radiation, such as Cobalt 60. These radiation sources are mounted on the sides of each fuel tank, along with detectors. Gamma rays given off by the sources pass through the fuel supply, decreasing in intensity as they do so. The amount of fuel is determined by the strength of the rays when they reach the detectors. A ratemeter converts pulses picked up by the detector into DC voltage and the amount of fuel is recorded in pounds by an indicator. *Atomics International, a Div. of North American Aviation Inc.*

Circle 56 on postcard for more data

New Three-Way Safety Brake System



As illustrated, the new brake system is superimposed on the hydraulic brake system of the existing vehicle. It consists of an air compressor and air reservoir for the power phase of the system; a master air-hydraulic power brake unit; a slave air-hydraulic power unit; and suitable accessories.

In the installation the master power unit is connected solely to the rear wheel brakes and operates only on the rear brake system. The slave power unit, actuated by the master unit, is connected only to control the front brakes. Hydraulic fluid lines are revised accordingly.

A new brake system features air over hydraulic actuation. It is said to be ready for installation on school busses, passenger cars and trucks up to 2½ ton capacity.

In the event of failure of a rear wheel cylinder or a break in the hydraulic line leading to the rear brakes, a slave unit will operate the front brakes to provide braking effort. Similarly, if there is any failure in the front brake system, the master unit will function to operate on the rear brakes. If there is a failure in the air supply braking still is available through the hydraulic system but without power. This explains the term "three way safety," providing brake operation even when there is a failure that would normally leave the vehicle without any brakes with a conventional brake system. *Kelsey Hayes Co.*

Circle 57 on postcard for more data

New Silicone

A recently developed, single component silicone is said to have excellent adhesion qualities for applications on metals, glass, silicones or organic resins. It is reported by the manufacturer that this silicone retains its resiliency in temperatures from −70 to 300 deg F. For a short time use, it can be utilized in temperatures up to 500 deg F. *Dow Corning Corp.*

Circle 58 on postcard for more data

Liquid-Oxygen Converter

Ten-liter liquid-oxygen converter (used in F-105) conforms to USAF specification MIL-C-25777A. Incorporates stainless-steel inner-shell and aluminum outer shell. Weighs 15½ lb and measures about 13 in.³ Specifications are: evaporation rate 2¾ lb/day; operating pressure, 70 psi; delivery rate 72 lpm for 1½ hr; temperature range, −65 to 20° F. *Linde Co.*

Circle 59 on postcard for more data

Tiny Tape Recorder

Airborne tape recorder for missiles and satellites weighs only 10½ oz. It records on one to 16 channels on a continuous tape. Resistance to shock is over 2000 G's. Power consumption is extremely low at 1½ watts. *Leach Corp.*

Circle 60 on postcard for more data

• • INDUSTRY STATISTICS • •

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Vehicle Make	Weeks Ending Jan. 30	Weeks Ending Jan. 23	Year to Date 1960	Year to Date 1959
PASSENGER CAR PRODUCTION				
Total—American Motors Corp.	10,457	9,785	40,836	34,316
Chrysler	2,540	2,268	9,886	5,660
De Soto	1,535	1,379	5,662	4,419
Dodge	8,440	8,417	34,331	11,440
Imperial	729	711	2,894	1,613
Plymouth*	13,732	13,506	53,913	28,328
Total—Chrysler Corp.	26,976	26,281	106,686	51,460
Edsel	.....	.....	.....	5,880
Ford*	42,888	43,370	173,931	134,030
Lincoln	857	858	3,430	3,558
Mercury	5,107	5,789	22,648	17,356
Total—Ford Motor Co.	48,852	50,017	200,009	160,824
Buick	7,809	9,087	33,316	35,316
Cadillac	4,310	3,961	16,589	16,553
Chevrolet*	51,094	50,899	195,550	152,162
Oldsmobile	10,374	10,869	41,226	40,693
Pontiac	10,167	10,956	41,473	38,905
Total—General Motors Corp.	83,754	85,772	328,154	283,629
Total—Studebaker-Packard Corp.	3,222	3,209	13,041	15,526
Checker Cab	80	.....	80	564
Total—Passenger Cars	173,341	175,084	688,806	546,319
TRUCK AND BUS PRODUCTION				
Chevrolet	11,877	11,630	43,045	34,795
G. M. C.	2,534	2,295	9,178	8,116
Diamond T	67	73	293	522
Divco	80	80	320	294
Dodge and Fargo	1,978	1,997	7,675	7,370
Ford	9,106	9,204	36,599	28,477
F. W. D.	35	22	99	83
International	3,005	2,744	11,433	5,277
Mack	325	338	1,279	1,478
Studebaker	157	160	630	1,359
White	424	400	1,622	1,470
Willys	2,730	2,615	9,759	9,112
Other Trucks	75	85	305	272
Total—Trucks	32,393	31,643	122,237	98,625
Buses	105	90	395	178
Total—Motor Vehicles	205,839	206,797	811,438	645,122

* Plymouth includes Valiant of which 19,991 were produced in January. Ford includes Falcon of which 100,757 were produced in January. Chevrolet includes Corvair—no production data available.

1959 TRUCK TRAILER SHIPMENTS

Industry Division, Bureau of the Census

Type of Trailer	November	Eleven Months 1959	Eleven Months 1958
Vans			
Insulated and refrigerated	393	4,158	3,214
Steel	30	496	356
Aluminum	363	3,662	2,858
Semi-insulated	106	1,133	495
Steel	106	1,133	495
Aluminum			
Furniture	72	1,386	1,395
Steel	64	1,141	1,395
Aluminum	8	245	
All other closed top	2,596	26,643	16,001
Steel	649	7,126	5,388
Aluminum	1,947	19,517	10,613
Open-top	280	2,856	2,138
Steel	98	1,193	951
Aluminum	182	1,663	1,187
Total—Vans	3,447	36,176	23,243
Tanks			
Non- and low pressure			
Petroleum			
Carbon and alloy steel	289	2,206	2,123
Stainless steel	14	273	204
Aluminum	184	1,657	1,292
Total—Petroleum	487	4,136	3,619
Chemical, food, fluid solids	58	510	506
All other, Incl. aircraft refuelers	72	1,373	676
High Pressure (LPG, chemicals, etc.)	34	333	332
Total—Tanks	651	6,352	5,133
Pole, pipe and logging			
Single axle	21	332	292
Tandem axle	24	949	562
Total	45	1,281	854
Platforms			
Racks, livestock and stake	44	511	1,419
Grain bodies, all types	105	1,556	943
Platforms (flats), all types	563	9,084	5,687
Total—Platform	712	11,151	8,049
Low-bed heavy haulers	169	2,303	2,140
Dump trailers	126	2,183	2,419
All other trailers	235	2,836	1,696
Total—Complete Trailers	5,387	62,282	43,534
Trailer chassis[1]	148	3,417	2,976
Total—Trailers and Chassis	5,535	65,699	46,510

[1] Sold separately.

NEW PASSENGER CAR REGISTRATIONS BY REGIONS

Zone	Region	November 1959	October 1959	November 1958	Eleven Months 1959	Eleven Months 1958	Per Cent Change Nov. over October	Nov. over Nov. 1958	Eleven Months 1959 over 1958
1	New England	25,763	30,080	18,961	301,272	233,439	−14.85	+51.90	+29.06
2	Middle Atlantic	74,641	98,504	63,023	992,398	800,143	−24.23	+18.43	+24.03
3	South Atlantic	56,656	67,922	45,060	736,898	539,398	−16.59	+25.68	+36.61
4	East North Central	104,241	131,743	80,982	1,418,769	959,733	−20.88	+28.72	+47.83
5	East South Central	19,599	24,457	15,246	250,585	178,804	−19.87	+28.55	+40.15
6	West North Central	37,105	47,739	27,199	502,523	394,230	−22.26	+36.42	+27.47
7	West South Central	35,558	47,803	31,993	495,965	374,907	−25.62	+11.14	+32.29
8	Mountain	17,104	20,398	12,034	208,104	154,194	−16.15	+42.13	+34.96
9	Pacific	56,262	65,036	46,170	690,486	501,832	−13.49	+21.86	+37.59
	Total—United States	426,929	533,682	338,688	5,597,000	4,136,680	−20.00	+26.05	+35.30

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn. Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex. Zone 8—Ariz., Colo., Ida. Mont., Nev., N. M., Utah, Wyo. Zone 9—Alas., Cal., Ore., Wash.

1959 TRUCK FACTORY SALES BY G.V..W.

As reported by the Automobile Manufacturers Association

Period	6,000 lb. and less	6,001-10,000 lb.	10,001-14,000 lb.	14,001-16,000 lb.	16,001-19,500 lb.	19,501-26,000 lb.	26,001-33,000 lb.	33,000 lb. and over	Total
First Quarter	155,408	51,094	3,915	25,857	35,133	15,806	10,358	9,801	307,372
Second Quarter	175,239	54,788	4,576	32,002	43,676	18,150	11,513	11,505	351,449
Third Quarter	132,318	34,647	2,833	16,537	33,026	15,693	10,270	9,083	254,407
Total—Nine Months	462,965	140,529	11,324	74,396	111,835	49,649	32,141	30,389	913,228
October	45,488	15,495	1,083	8,959	11,271	5,386	4,103	3,208	94,983
November	24,232	8,541	919	4,437	6,981	3,384	3,238	2,236	53,968
December	36,314	11,079	703	5,322	9,328	3,709	3,407	2,807	72,669
Fourth Quarter	106,034	35,115	2,705	18,718	27,580	12,479	10,748	8,251	221,630
Total—12 Months—1959	568,999	175,644	14,029	93,114	139,415	62,128	42,889	38,640	1,134,858
Total—12 Months—1958	446,292	127,157	14,006	81,798	96,526	50,356	29,781	28,362	874,278

Observations

By Joseph Geschelin

Too Early

We were thinking recently how well some of the small cars of earlier days would fit the picture today. We refer to Bantam, prewar Willys models, Hudson Jet, Henry J, as prime examples. Here were cars just too far ahead of the day. Yet by the standards of small cars of today they were real good-looking, real motor cars, and had plenty of performance. They were just born too soon.

Highway Safety

Public officials always take a poke at the motor car industry about built-in safety. Yet the fact remains that most accidents are caused by drivers, many caused by poor operating conditions—brakes, lights, windshield wipers. Public officials have a major responsibility in this area. Why is it we see cars around Detroit that have not been repaired after collision damage? Why are they permitted on the streets with a headlamp or a tail light taped up? When we see a car without a hood or without a fender or with the deck lid stove in, we try to get off that street as quickly as possible.

Economy Figures

What is fuel economy? It seems to us that fuel economy is a rather elusive thing. It depends on how you drive, where you drive, and what traffic conditions are. It also depends upon how a particular engine is tuned. We are quite sure that the same car with a different driver will get a different result. That being the case a real economy car should have a lot of tolerance in fuel economy to make it safe for the sales department to publish a good estimate of miles/gallon.

Machinery Buying

Some comments we picked up recently in large plants indicate that many machine tool builders have large orders on hand for equipment to make 1961 cars. One master mechanic told us recently that he has to wait a month to five weeks just to get a quotation. That's how busy some of the machine tool builders are.

Small Cars

The way things are developing we shall have to find entirely new nomenclature to define a "small" car. Falcon, Valiant, Corvair are small cars; Rambler is a "compact." What do we call the Comet and Dart and some of the other smaller cars expected next year? What do we call them if they come on a wheelbase of less than 100-in.?

Quality Service

Amazing how many people evinced an interest in the item we had October 1 regarding an outstanding Buick dealer in the Detroit area. In our opinion a good dealer who is interested in making friends of his customers is just as much of an asset to a motor car manufacturer as is a good product. Maybe even more so.

Car Interior

Our feeling, and it is shared by many people, is that roof lines are just about as low as they can get. And the next move should be upward to make it easier to enter and leave. The population of older people is steadily growing and many of them drive cars. It seems that the joints are not as flexible when you pass 40, certainly not as flexible as those of the beautiful models. The matter of ease of entry and egress is serious and should be given consideration.

Smog Control

We have a letter from a chemical company in California advising they have under wraps a pyrocatalytic afterburner they call the Midget Smog Burner. They have made no announcement to date, claiming that in February the California State Board of Health is expected to release a "minimum standard" for afterburners. We are intrigued by the statement that this particular device can be mass-produced for $10 to $15. (For record—Stack Chemical Co., Encino, Calif.)

Labor Cost

With the higher labor costs prevailing in the USA and constantly on the rise, we are rapidly pricing ourselves out of world markets. Besides, we are being flooded with lower cost—high quality—cars and goods from overseas. Eventually, there will come a cry for protective tariffs. But that will not be the answer to competition. As recently as World War II we enjoyed the benefits of mass production and later of automation. Even these vital areas no longer exist. The fact is that the major producers in Europe can match our methods and facilities — wiping out the only hedge we enjoyed in productivity. Perhaps some one can tell us what the answer is to all this.

New Transfer Machines

(*Continued from page* 68)

The machine has a total of 72 palletized fixtures, each of which weighs 1000 lb, and holds two work pieces. It performs a total of 110 cutting and probing operations. In addition it has nine electrically controlled drill checks to indicate broken drills and automatically stop the machine.

The pallet system incorporates a number of different types of transfer including: single-index sliding pallet transfer; double-index sliding pallet transfer; walking beam, lift and carry pallet transfer.

The operator control console has 358 of the new type bright neon lamps, arranged in the same relative position as the location of an operation on the machine. Besides this, there are 34 press-test indicating lamps and 29 control buttons and switches.

The sequence of operations is given at left, listing only working stations.

To summarize the foregoing, the big Buhr machine has 39 working stations, with 59 heads in operation. It will be noted too that numerous holes are processed a number of times at different stations—drilling holes part way, boring, reaming, etc. Also noted above are a few angular holes which require repeated operations to completion. In the case of angular holes Buhr has equipped the heads with Vickers hydraulic motor drive to simplify the installation, particularly since these are all holes of small diameter. ■

Station	Head	Operation
4	RH	Rough-bore two large diameters.
6	RH	Rough-bore and chamfer large diameter.
7	LH	Core drill half-way and spot drill at four points in flange.
	RH	Rough face mill open end.
9	LH	Rough counterbore stem end.
	RH	Drill 3/16-in. angular hole.
		NOTE: Angular holes are handled by means of hydraulic motor-driven units at various points on this machine.
10	LH	Core drill one hole; tap four holes in flange.
	RH	Drill angular hole to depth.
12	LH	Rough-ream hole in flange.
	RH	Plunger hole drill with 90-deg. point.
13	RH	Drill one hole, tap two holes.
	LH	Drill angular hole part way.
15	LH	Spotface two holes.
	RH	Drill through, rough-spotface one hole.
16	LH	Drill angular hole to ¾ depth.
	RH	Drill angular hole to depth.
18	LH	One 33/64 in. hole drill through, 35/64 in. rough drill.
	RH	Drill one hole, rough counterbore 1.25 in. diameter.
19	LH	Chamfer diameter.
	RH	Rough-face inner face.
21	LH	Finish counterbore diameter in hub, semi-finish counterbore larger diameter.
	RH	Rough recess three grooves.
22	LH	Spotface two holes, spotface hub end.
	RH	Drill through angular hole.
24	LH	Drill angular hole through in hub end.
	RH	Ream angular hole.
25	RH	Drill plunger hole through.
27	LH	Drill through web hole, finish-counterbore larger hole.
	RH	Drill hole to length.
28	LH	Finish-ream hole in hub end.
	RH	Drill two holes, countersink two holes in flange.
30	LH	Probe angular hole in hub, blow out one hole.
	RH	Rough-ream plunger hole.
31	LH	Press babbitt bushing in hub end.
		This station is equipped with a Feedall unit and a Syntron attachment for feeding bushings to the parts; and an attachment for orienting them in proper alignment.
35	LH	End-mill one hole.
	RH	End-mill to clear hole.
36	LH	Drill hole part way.
	RH	Drill hole part way.
37	LH	Drill hole through.
	RH	Drill hole through.
39	LH	Finish-face-mill open end.
41	LH	Finish-counterbore hole, finish spotface other hole.
42	LH	Countersink two holes, counterbore and chamfer hole.
44	LH	Ream one hole, counterbore two holes.
	RH	Tap four holes.
45	LH	Step-ream plunger hole.
47	LH	Tap two holes.
	RH	Subland drill one hole through.
48	LH	Tap one hole, probe two holes.
51	LH	Finish-recess three grooves.
53	LH	Finish-bore two large diameters.
54	LH	Finish-bore large diameter.
56	LH	Finish-face inner surface.
60 & 61	RH	Finish-bore babbitt bushing and seal diameters.
		These two stations are equipped with Ex-Cell-O precision-boring machines. Interesting feature of the set-up is that babbitt chips are removed by means of a vacuum attachment to prevent chips from mixing with cast iron chips.
62 & 63	LH	Bore-ream plunger hole.
		This operation is accepted in a range: 0.6675-0.6680 in.
68	LH	Ream two holes.
69	LH	Ballize plunger hole (0.6675-0.6680 in.).

FARM EQUIPMENT INDUSTRY

(*Continued from page* 78)

Diesel engine, of 144 cu in. displacement, produces 35 hp at the flywheel, and has a constant running p.t.o. A 12-volt electrical system, independent hydraulics, eight speeds forward, self-energizing disk brakes, direct electric starting, and a weight transfer system to utilize all its tractive effect are other features.

Harvester also announced that direct-start Diesel engines have been adapted for use with its McCormick combines Nos. 101, 151, and 181. The UD-236 6-cylinder International Diesel, used in the Farmall 460 tractor and developing 60 hp, goes into the No. 101 combine, and the UD-282 6-cylinder Diesel, from the Farmall 560 tractor and developing 80 hp, finds use in the 151 and 181 combines. ■

METAL FINISHING in the Body Plant

(*Continued from page* 72)

control, keeping the coated abrasives in their original packages until ready for use, and the provision for heated storage cabinets on the line can provide an effective substitute.

Solder booth sanding employs a number of coated abrasive articles including disks, belts, sleeves, cones, cartridge rolls and reinforced cloth bands. Recommended operating speeds for disks are in the neighborhood of 5400 rpm for 7 in. diameter disks, and 4250 rpm for 9⅛ in. diameter disks. Both of these speeds yield a sanding speed of approximately 8500 sfm at the periphery of the disk, under normal loaded tool conditions. This sanding speed has been found effective for the solders now in general use, and a variety of acceptable portable tools are available in these speed ranges. Slower speeds result in a lower rate of stock removal, and give no particular advantage. Higher speeds increase the tendency of the disk to pull out, rather than cut out the solder, and increase the possibility of the disk breaking due to snagging, particularly in the hands of an inexperienced operator.

Disk failure due to bits of solder loading onto its surface is usually not encountered, since the disk is used enough on the body steel around the soldered areas to keep it effectively clean. If this loading condition is encountered, the disk may be easily cleaned by lightly touching it, while running, to a wire brush attached to the booth wall near the operator's station. The use of lubricants always increases the life and cutting effectiveness of disks when sanding solder, and a small amount of light oil is sometimes brushed on the soldered seams before sanding for this purpose.

Almost all automotive plants now obtain extra use from resin bond sanding disks by cutting the disk down to a smaller diameter after it has been fully used in its original form. Current practice is to usually use 7 in. rather than 9⅛ in. diameter disks for most solder booth jobs, due to the smaller disk's ease of handling and lower original cost. These disks are then cut down to approximately 5 in. for further use on jobs such as trimming window areas, where the smaller size disk can be used to advantage.

The use of belts in the solder booth is often required by the contours to be sanded. From the standpoint of abrasive economy, it is always cheaper to use the longest belt possible. This is because a substantial part of the belt cost is represented by a "joining" charge for making the belt splice. For belts of the same width, this charge is the same no matter what the length of the belt is and, therefore, more square inches of usable abrasive are obtained per dollar with the longer belt. In addition, the greater slack-of-belt span obtained with tools using longer belts has been found desirable for some of the difficult contours on current 1960 models.

An effective type of coated abrasive for use on belt work is the "resin - over - glue" bond material. This type of material, as compared to the straight glue bond material, is usually found to give considerably longer service, which more than overcomes its greater initial cost. The abrasive bond on this combination glue-over-resin product is of the right degree of toughness to "break down," that is, to wear away in such a manner as to continually expose new cutting points when sanding on solder. Straight resin bond belts normally prove too tough for solder work and do not break down, with the result that the belt surface glazes over and loads with solder.

In addition to the basic disk and belt operations, the most efficient tool for solder booth work has proved to be the expandable rubber slotted drum. This tool is now widely used for touch-up and auxiliary sanding operations. The slotted drum offers two unique features: it is a true quick-change device, allowing the abrasive sleeve to be easily slipped on and off, and the serrated drum face behind the coated abrasive is considerably more effective in terms of stock removal than the cutting action produced by a smooth-faced drum. This type of expandable drum is available in wide varieties of size, hardness and type of serration. The straight resin bond sleeves can often be used here, since the aggressive action of the slotted wheel helps the coated abrasive to break down and produce full abrasive life.

Coated abrasive sleeves are also used on air-inflated drums, which offer the advantage of laying into contours and producing a fine finish. However, air drums also produce a comparatively slow rate of cut, and trouble may be experienced from "flat tires" due to snagging.

Coated abrasive cones are probably the most inefficient sanding tool, from the standpoint of abrasive life which are currently in use on body lines. Cones remain popular with operators because of the ease with which difficult contours may be reached; however, the practice of stacking several cones on a spindle always results in the coated abrasive being chewed up before any more than a fraction of its potential service is obtained. It is now a proven fact that careful use of belt sanders and the correct expandable drums can eliminate cones, with consequent savings in abrasive costs.

The various body metal clean-up areas following the solder booth complete preparation of the white metal for the paint operations. Solder joints are reworked, using coated abrasive cloth sheets a grit size or two finer than the disks used in the booth. This is done both by hand and with various types of sanding blocks. Using cloth sheets by hand is almost always costly abrasive - wise. Inspection of the used sheets usually shows a fourth or a third of the abrasive unused. The only effective way of combating this, other than operator education, is insisting that small pieces, either quarters or sixths of sheets, be employed.

Metal imperfections are removed with fine grit resin sanding disks, employing a flexible back-up pad. Disk shape may be round, octagonal, or two square disks placed together to form an octagonal disk. These latter two shapes offer the advantage of presenting a disk periphery to the work which will yield under pressure and minimize swirl marks. However, since only the points of the disk are used for sanding, the effective abrasive usage of these disks is comparatively low, and their use is recommended only where operator inexperience prevents the use of a round disk.

Minor surface blemishes and sanding marks are camouflaged using either oscillating "jitterbug" sanders, or flexible sponge pads using coated abrasive disks held on with pressure-sensitive adhesives. In both cases relatively inexpensive glue bond papers are normally employed. Papers having the abrasive grain covered with a stearate, which is a dry lubricant, are also used for these applications because of the longer abrasive life obtained with this product.

Molded cloth disks, variously called "mushrooms" or "beanies," have been tried on almost all applications in the solder booth and metal clean-up areas during the past model year. While its special shape makes this disk valuable for certain contours, it has failed to find wide acceptance due to the inherently high abrasive cost.

Set-up wheels, having abrasive grain glued to a cloth wheel, are also used for camouflaging and high-lighting. These wheels have long been unpopular due to their short life and over-all high cost. Current development work indicates that a low-cost coated abrasive tool can be developed for these applications, with a subsequent abrasive cost savings to the automotive plants.

The hood and fender line represents another area where coated abrasive costs are important. Current practice is divided between resin bond (green back) disks and glue bond (blue back) disks for removing surface imperfections and metal high-lighting. Resin bond disks invariably produce a cost savings when substituted for glue bond disks, and their use in the hood and fender area is highly recommended. However, the resin disks require a different sanding technique, and their introduction usually results initially in excessive swirl marks and gouges in the metal surface. During this changeover period, the use of softer back-up pads, or the substitution of octagonal resin disks will aid in maintaining quality until operator experience is gained with the more aggressive-cutting resin disks.

The general approaches to greater abrasive economy described above can be employed at any body plant when setting up cost reduction programs. Personnel at each plant, however, must select the sanding methods best suited to their own particular operating conditions. The coated abrasive suppliers stand ready at all times to help the body plant stretch its coated abrasive dollars into more profit. ■

Part II of this two-part article will appear in an early issue of AUTOMOTIVE INDUSTRIES.

SAE Annual Meeting

(*Continued from page* 76)

3000 rpm, a V-8 with 570-cu in. displacement, weighing 1250 lb.

Clutches: Lipe-Rollway Corp.—Type DPB 15-in. flat-face clutch, available in single-plate type with static torque capacity of 925 lb-ft, also in two-plate type with rating of 1850 lb-ft. Bendix Aviation Corp.—Mini-Pak air-operated power-assist unit for truck clutches, which works in conjunction with a hydraulic master cylinder.

Front Axles: Anderson-Bolling Mfg. Co.—Dual-wheel front steering axles in 18,000 and 30,000-lb sizes, of a design which permits each tire to rotate independently and also to brake individually.

Brakes: Bendix Aviation Corp. —Power brake valves for operating brakes on vehicles with centralized hydraulic systems or sources of hydraulic pressure. Kelsey-Hayes Co. — Safety brake system for school buses which with air-over-hydraulic actuation provides either front or rear braking in case of line failure, and also provides for unpowered actuation of hydraulic rear brakes in case of air supply loss. Midland-Ross Corp.—Vacuum power brake unit which uses standard master cylinder and needs no reservoir.

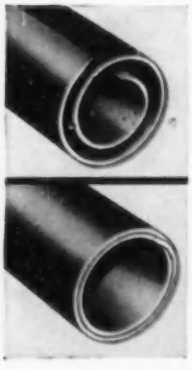
Starting Motor: Electric Autolite Co.—starting motor with coaxial built-in shifting solenoid for directly actuating the drive clutch without intermediate linkage.

Nickel: International Nickel Co., Inc.—Engine and other automotive parts made of ductile iron; plating of bumpers with double layers of nickel before chromium plating; electro-polished stainless steel for matching colors and finish of other trim parts.

Plastics and Elastomers: E. I. du Pont de Nemours & Co.—Numerous product applications of Teflon, Delrin, Zytel, Viton, Adiprene, Neoprene, and Hypalon. One interesting item was an air cleaner element made of cellular urethane foam. Another was hollow weather stripping extruded from Neoprene. Reservoir, pump and injectors of new Walker automatic lubrication system, made of Zytel and Delrin, also on display. Enjay Co., Inc.—Escon Polypropylene, a new thermoplastic made by controlled polymerization of propylene and applicable to numerous automotive functional parts.

Lubricant Additives: Enjay Co., Inc.—Paratone 400 Series viscosity-index improvers for motor oils, which also provide sludge dispersancy and detergency; Paranox 375 automatic-transmission-oil detergent inhibitor. ■

There's almost no limit to the things Bundy can mass-fabricate



Bundyweld is the only tubing double-walled from a single copper-plated *steel* strip, metallurgically bonded through 360° of wall contact for amazing strength, versatility.

Bundyweld is lightweight, uniformly smooth, easily fabricated. It's remarkably resistant to vibration fatigue; has unusually high bursting strength. Sizes up to ⅝" O.D.

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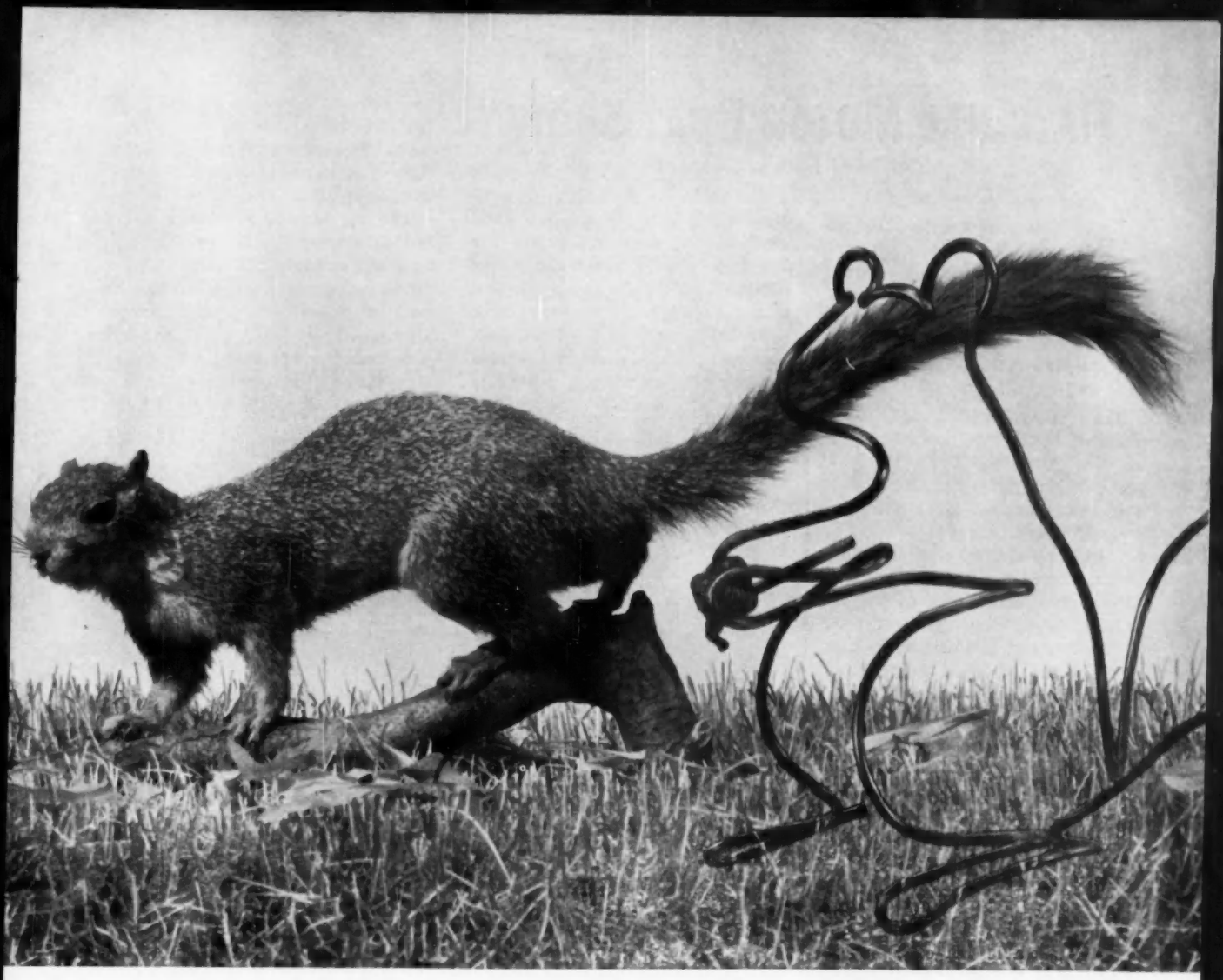
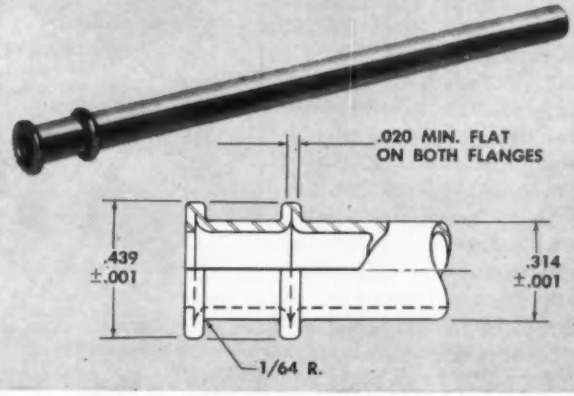
Next time you have a tubing problem, better call Bundy *first.* Phone, write, or call Bundy Tubing Company, Detroit 14, Michigan.



This oil transfer tube illustrates the precision with which parts are mass-fabricated at Bundy. Two flanges are formed on the Bundyweld tube as shown in the diagram. The opposite end of the tube is held to .314" with a tolerance of only ±.001". Bundyweld double-walled steel tubing has the necessary ductility to form this tube, *plus* amazing strength that withstands severe punishment. Can Bundy's mass-fabrication experience help *you* with tubing problems?



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NATIONAL MOTOR BOAT SHOW

(*Continued from page* 59)

Hercules Motors Corp.

Three inboard marine Diesels were displayed at the show by Hercules, and the company's exhibit included representation of the new "Polydiesel" design which is built to operate on Diesel fuel but which is also operable with gasoline, kerosene or jet fuel.

The "Polydiesel" models emphasized in the marine line consist of two. One, the D-426-M, is a vertical six-cylinder unit with a bore and stroke of 4¼ by 5 in. and a piston displacement of 426 cu in., rated 145 hp at 2600 rpm. The second model is the D-662-M, a V-8 with a bore and stroke of 4¾ by 4¾ in., a piston displacement of 662 cu in., and a rating of 200 hp at 2600 rpm. Weights are given as 1700 and 2250 lb, respectively.

Two four-stroke straight-Diesels are also being offered for marine use. Both are six-cylinder engines of 339-cu-in. displacement, but available in vertical and horizontal configurations. They are rated 125 hp at 3000 rpm, and weigh about 1200 lb. Bores and strokes of these models, the D-339-HM and D-339-HFM, are 4 by 4½ in. The flat version has a length of 57 in., a width of 33⅞ in., and a height above shaft centerline of 11 in.

McCulloch Corp.

In a very elaborate and extensive display of the 1960 Scott line of outboard motors (see AI, Jan. 15, page 121), McCulloch included its R-120 experimental outboard motor. This unit, "built to explore new design techniques," has quite a number of unusual design features.

Its four cylinders are located radially in a horizontal plane, the two-stroke engine has direct fuel injection of gasoline, and it is turbocharged. Bore and stroke are 3.25 by 2.72 in., for a total piston displacement of 90 cu in. Rating is 110 bhp at 4200 rpm. The lubrication system is of the pressure type with a separate supply (oil is not mixed with fuel). Weight of the complete watercooled unit is about 260 lb. It is about 18 in. wide, 26 in. long, and 52 in. high.

The main body of the motor is mounted to the transom in a fixed position and does not swivel for steering. Only the extreme lower portion of the motor leg turns, and this is electrically-controlled and hydraulically-operated. The unit also has a 14-in.-diam three-blade variable-pitch propeller, which is likewise electrically-controlled and hydraulically-operated. Trim and tilt are adjustable by the same mode of remote control and operation. Engine controls are electric-motor-operated.

The engine is so mounted on extended brackets each side that its axis of swing-up is through its center of gravity. It also has a built-in two-way hydraulic shock absorber.

Scavenging of the cylinders for starting and part load operation is handled by a compressor turning

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Lamb® six-pole 400 cycle AC motor for operation submerged in jet fuel for booster pump drive. Frame: 2⅞ x 2½
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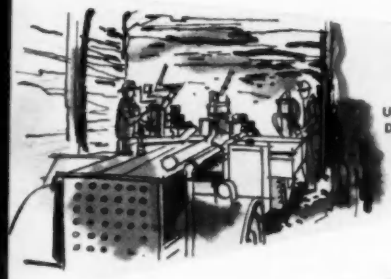

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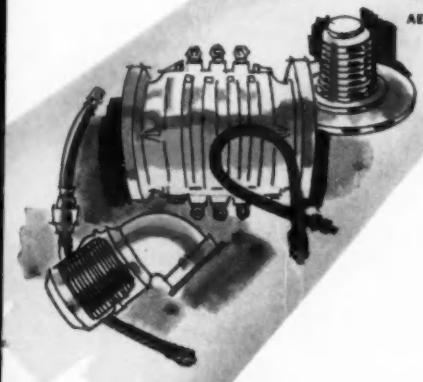

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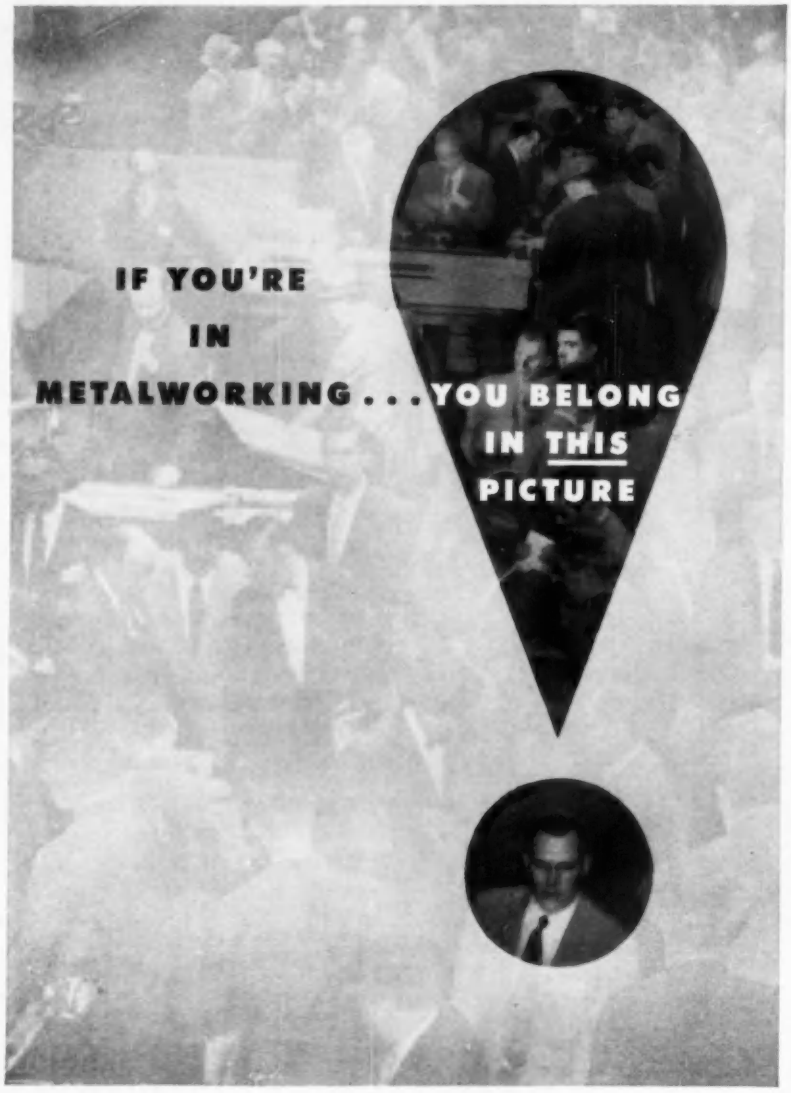

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at crankshaft speed and by a turbocharger which becomes effective at higher engine speeds. Brake specific fuel consumption is said to be 0.55 lb-bhp-hr; and brake mean effective pressure 116 psi.

Oliver Outboard Motors

The 1960 line of this division of The Oliver Corp. consists of the 35-hp Bulldog, the 16-hp electric-starting Lancer, the 16-hp manual-starting Ranger, and the 6-hp Mohawk. The 35-hp Bulldog is also being offered in twins with counter-rotating propellers. These motors are now being manufactured in England by F. Perkins, Ltd.

The 35-hp Bulldog, equipped for electric-starting, is a two-cylinder unit with a total piston displacement of 42.35 cu in. Its rating is at 4500 rpm, and weight 129 lb. Features include use of poppet-type valves, low-tension magneto with 5-amp 60-w flywheel alternator, and single-lever remote control.

The Lancer and Ranger are 19.94-cu-in. models rated 16 hp at 4500 rpm; while the Mohawk has a piston displacement of 9.42 cu in. and is rated 6 hp at 4500 rpm. The latter model weighs 57 lb. All are two-cylinder motors.

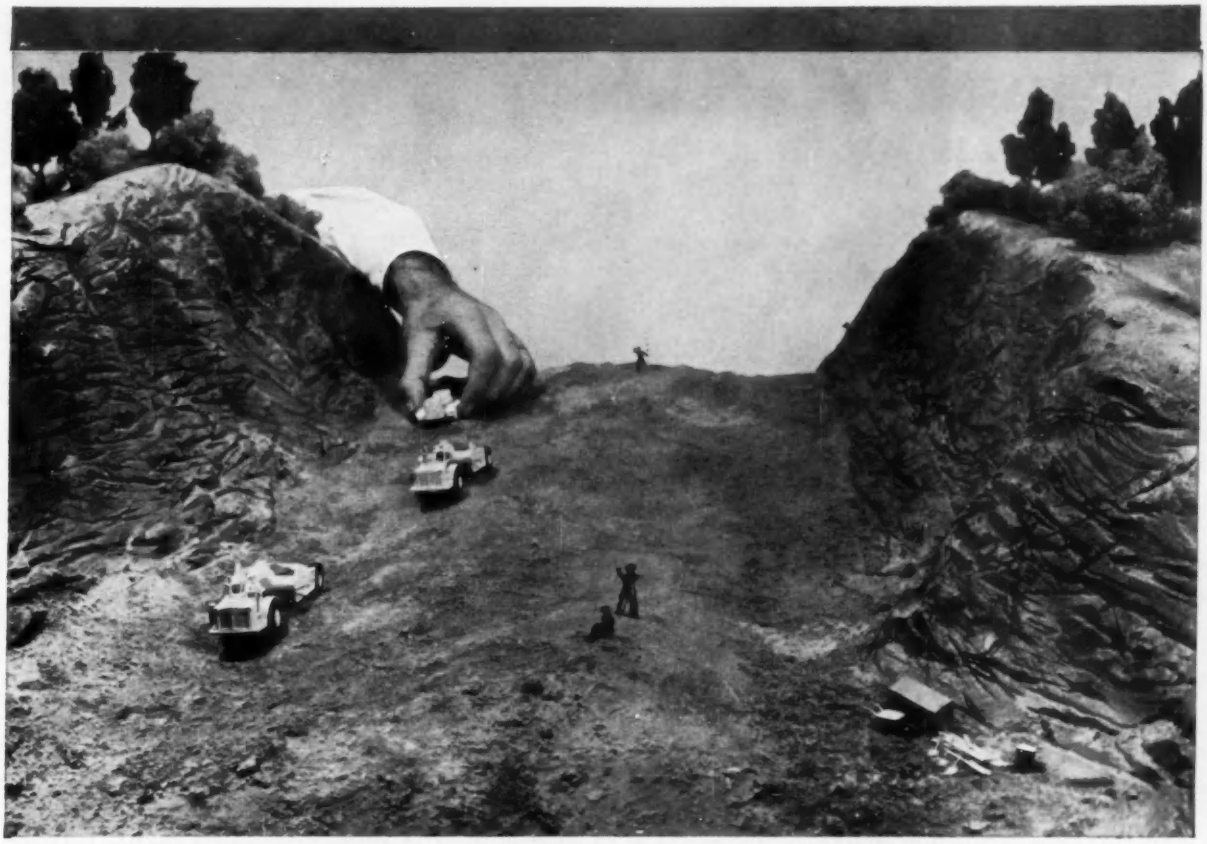
Palmer Engine Co.

Two new V-8 gasoline marine engines, rated 200 and 300 hp and based on International Harvester truck-engine cylinder blocks, were introduced by Palmer at the show.

The larger of the two new ohv V-8 engines is the IH-V549, rated 300 hp at 3600 rpm. It has a bore of 4½ in. and a stroke of 4 5/16 in., for a total piston displacement of 549 cu in. Its compression ratio is 7 to 1. Weight, including fresh-water thermostatically-controlled cooling system and standard equipment 1½ to 1 reduction gear, is 1600 lb. This engine is equipped with a four-barrel downdraft carburetor.

The IH-V345 is the other new V-8, rated 200 hp at 4000 rpm. It has a bore of 3⅞ in., a stroke of 3 21/32 in., and a total piston displacement of 345 cu in. Weight with direct drive is 900 lb. Features include separate coolers for hydraulic-transmission and engine

(*Turn to page 97, please*)



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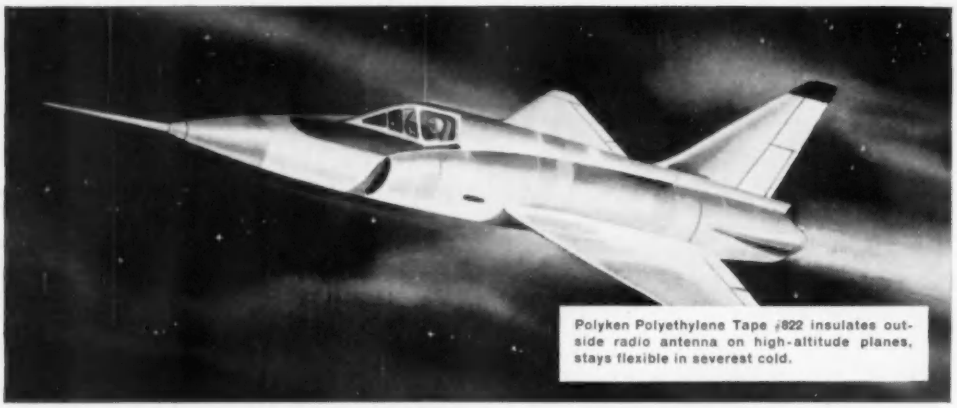

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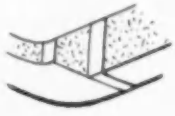

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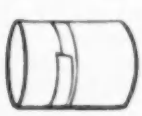

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NATIONAL MOTOR BOAT SHOW

(*Continued from page* 94)

oils; and gear-driven water pump and generator. The intake manifold is a one-piece aluminum alloy casting, fitted with a "depressed," or nestled, four-barrel downdraft carburetor. Overall height of the engine from shaft centerline is only 15 in.

The 1960 line of this company consists of 10 inboard models, in horsepower ratings of 8, 22, 60, 120, 135, 150, 200 and 300, and in configurations of one, four, six and eight cylinders — including two "slanted" six-cylinder "Spacemaker" models.

Precision Gears & Products, Inc.

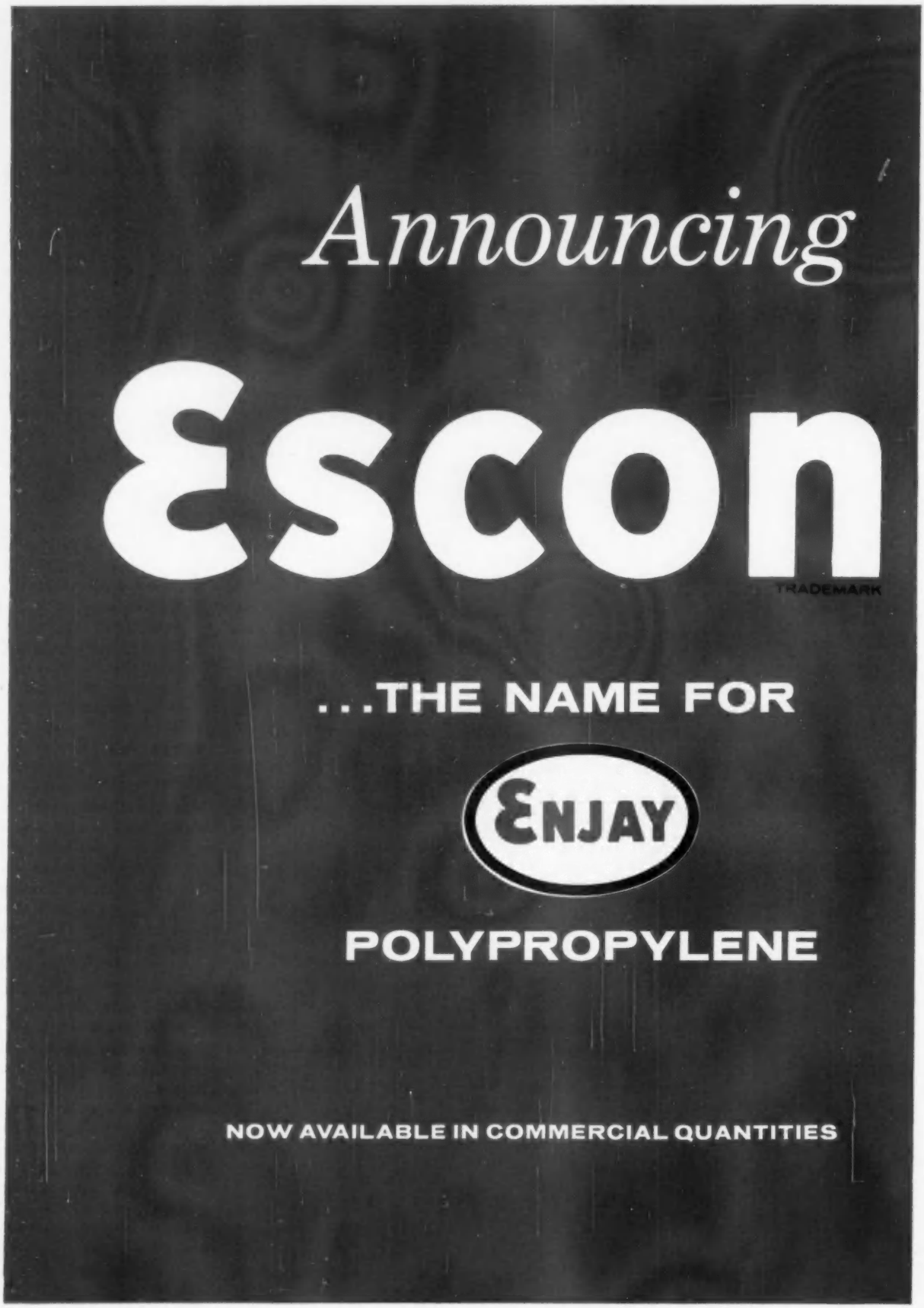
A gas turbine inboard-outboard engine was exhibited by this company, whose primary component products are gear drives for helicopters and marine engines.

Named "Turbinautic," the major elements of the package consist of the gas turbine engine, gear assembly to reduce turbine wheel speed to desired propeller speed, and hydraulic clutches to provide forward, neutral and reverse.

The engine displayed was said to be rated at 100 hp—and the company is talking in terms of marine drives for gas turbine engines of up to 250 hp. It was also indicated that the gas turbine engine portion of the display model was a Solar unit. Weight of the complete motor is stated to be less than one pound per horsepower.

The gas producer is mounted against the inside of the transom, and the drive is fastened directly behind it on the outside. Flexible tubing links the two sections so that the drive can be swung from side to side for steering.

Company officials say the Turbinautic is now in the development stages and is in the process of undergoing tests at the factory in Paterson, N. J. Also that it is scheduled to be installed in a skiff and water-tested this spring, following which the drive unit and engine will be evaluated under a wide variety of boating conditions.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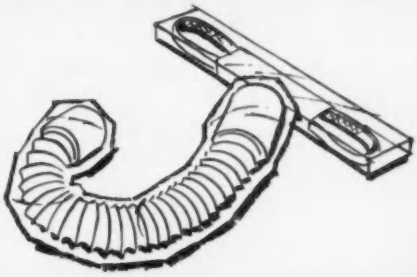

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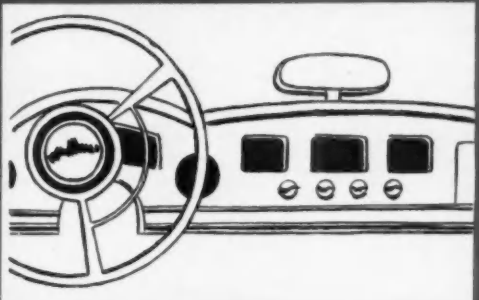

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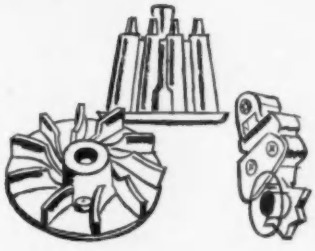

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Rolls-Royce Aluminum V-8 Engine

(*Continued from page* 62)

another Jackson & Bradwell.

This machine is a universal type, and during the balancing sequence metal removal from the counterweights is done on an adjacent grinder, with the shaft transported back and forth on a chain hoist. Two men with separate crankshafts use this setup together, alternating between the balancer and the double-ended grinder. Each shaft takes about two hours to complete.

Lastly, all bearings and pins are simultaneously lapped on a special machine built by Rolls-Royce. Based on a lathe, it has nine freely-pivoting arms that are swung over the corresponding mains and pins of the crankshaft centered below. Rolls of fine-abrasive paper are carried on each arm, and air-operated jaws clamp the exposed strip to the bearing. During crank rotation the appropriate jaws and arms are reciprocated independently by the pins, and bearings are lubricated by oil sprayed from beneath.

When the V-8 engine was introduced Rolls-Royce bought the hydraulic tappets outright from Chrysler, but now they are made locally under license. After initial machining the plunger and body are ground, assembled and tested in an air-conditioned room.

Bodies are internally and externally finished on a Heald Size-Matic while plungers are ground on a Studer. The two parts are passed through an ultrasonic cleaner and then mated, with clearance closely held to 0.00025 in. Completed tappets are given a leak-down test in a kerosene bath that checks the compression time under a 50-lb load. Work time for a set of 16 tappets is 30 minutes.

Engine assembly is as exacting as machining, and only skilled men are employed in this section. Each liner is experimentally positioned by rotating it in its cylinder bore until the top flange, seating in the bore recess, protrudes above the joint face by the specified 0.002 to 0.003 in. It is later retained by a corrugated steel gasket compressed by the cylinder head. When correctly aligned, the liner is temporarily withdrawn to insert the rubber sealing rings in the bore.

Cylinder blocks are then bolted to rotary trolley-mounted fixtures hand-propelled along a short length of track. At the start, the crankshaft assembly is added, followed by the matched set of pistons and connecting rods. Connecting rod bolts, now integral with the rod, are tightened to a gaged length without using lock nuts or washers.

Completed engines are dynamically balanced on a specially-built Avery machine. By way of preparation the crankcase and fluid clutch are filled with oil, cylinder heads are removed, liners are clamped down by narrow bars retained by the studs, and oil from the rocker-shaft ducts is piped back to the crankcase by plastic tubes.

The crankshaft is driven at 750

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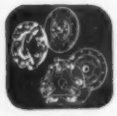

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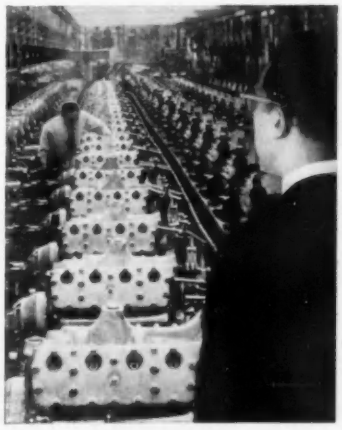

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rpm and unbalance is corrected by radial drillings in the solid flange of the forward vibration damper which is reached through a guide hole in the mounting cradle. In addition, compensating weights are bolted to the starter ring at the rear. These are metal strips of varying thickness, graded down to half a gram. The entire procedure takes about one hour.

All engines are run for 2½ hours on a drake before being installed in a chassis. Every 50th engine off the line is run for 6 or 7 hours and every hundredth for 25 hours, after which it is completely stripped and each part is individually gaged for wear. This is a two-day operation, including reassembly. In fact, every one of the first hundred V-8s made was given this thorough inspection.

As for the chassis and the car itself, a few of the highlights warrant a short summary. Sealed, box-section frame members are pressure-tested for leaks. Cooling fins on the iron brake drums are machined from the solid. Offset of the hypoid rear axle is only a tenth of the ring gear diameter to insure silent running.

The ring gear itself is carburized by an intricate process so that the teeth are hardened while the back remains soft. It is initially copper plated all over to a thickness of 0.0001 in. in a cyanide copper bath. The area to be protected is then hand-painted with a paste of ethylene glycol or glycerine mixed with fine whiting powder. Following this the entire gear is dipped in hot protective wax, and when cool the wax coating is cut from the surface to be stopped off during carburizing. It is copper plated in an acid copper sulphate solution to a minimum thickness of 0.002 in. Then the gear is immersed in boiling water to melt the wax, and in a bath of 10 per cent aqueous solution of chromic acid to remove the 0.0001 in. of copper. After washing and drying it is finally carburized.

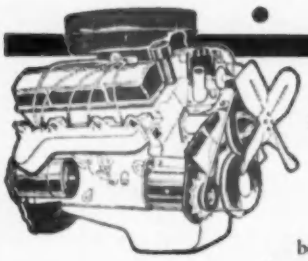
In the field of mechanical reliability Rolls-Royce pursues a "belt and suspenders" policy by using four drive belts, three independent braking systems (two hydraulic and one mechanical on the rear wheels, all pedal-operated), and two electric fuel pumps in tandem.

Bodies for the Rolls-Royce Silver Cloud and Bentley S.2 are made by Pressed Steel and reach Crewe in white, where they are given a total of eight coats of paint before trimming. Completed cars are individually road-tested for some 200 miles by different specialized engineers, and are not checked out until all possible flaws are eliminated.

Wind noise receives special attention, and doors may even be rehung if this is excessive. Chassis destined for outside coachbuilders are similarly tested, fitted with a simple bolt-on body to simulate actual motoring conditions. Before being released to the customer each car is masked off, rubbed down, and sprayed with the final coat of cellulose. ■

This is the final part of a two-part article by David Scott. Part I appeared in the Jan. 15 issue of AUTOMOTIVE INDUSTRIES

JOHNSON *tappets*



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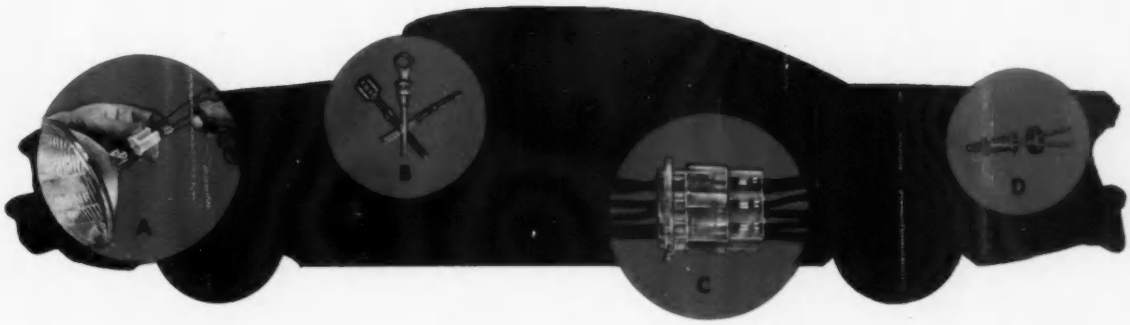

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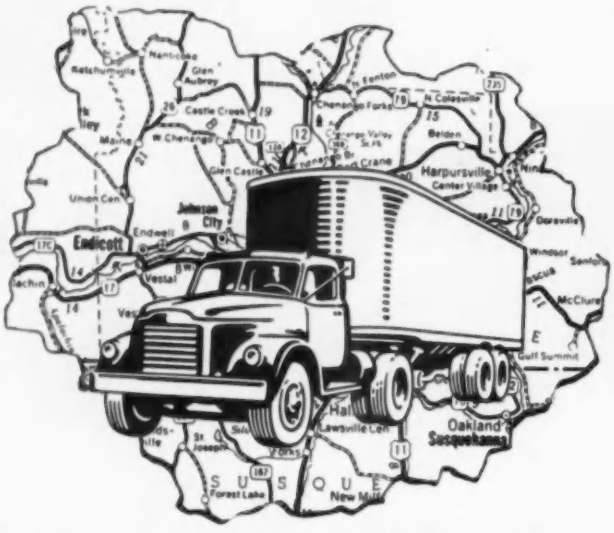

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ALWAYS SPECIFY SNYDER

Snyder Tank
CORPORATION
P. O. BOX 14, BUFFALO 5, N. Y.

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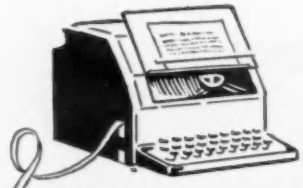


ON OUR WASHINGTON WIRE

Congressional Democrats are building their attack on the Administration's space program early. The House Space Committee has started a study aimed at showing the Eisenhower Administration has provided "too little funds, too little push, too little imagination" in running this country's space program. At least three Congressional probes are likely this year.

Government officials have joined other Americans and are trying out compact cars for official duties. The General Services Administration has ordered 340 Rambler Americans and 491 Studebaker-Packard Larks. These were the first compacts ordered by the Government. The GSA also purchased 3753 light trucks, 54 passenger cars and six station wagons from General Motors; 351 light trucks and 237 station wagons from Chrysler Corp. and 136 station wagons from American Motors.

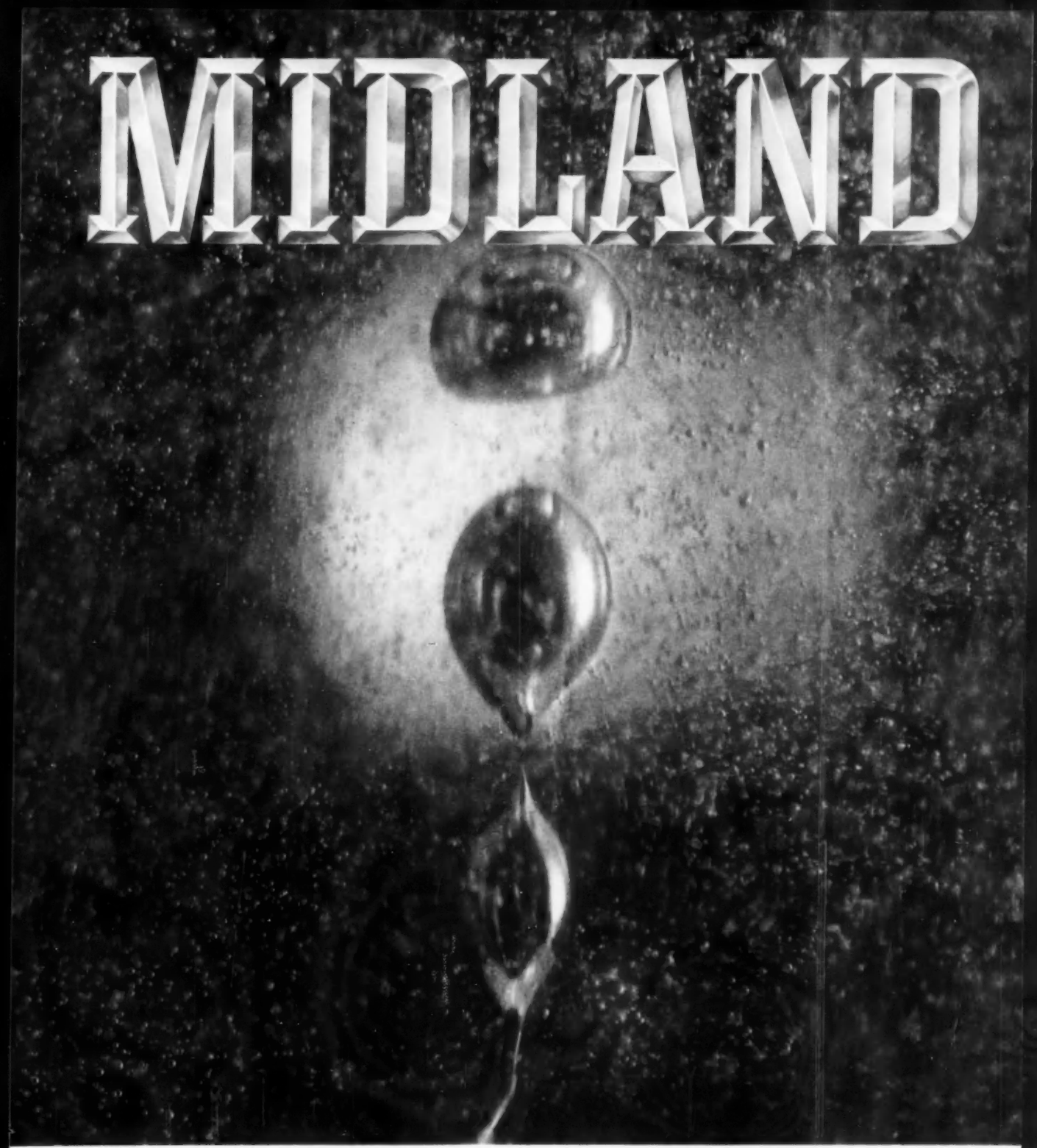
Total repeal of the excise tax on travel by bus, air and rail is being pushed in Congress. Rep. Lee Metcalf (D., Mont.) argues that the original purpose of the tax, scheduled to drop from the present 10 per cent to 5 per cent on July 1, was to discourage travel during World War II.

It costs the Government an average of slightly more than 11.6 cents a mile to operate its huge and still-growing fleet of trucks, buses, and cars. The U. S. now owns some 250,000 vehicles, including 116,000 trucks up to one ton; 27,600 trucks of 1½ to 2½ tons, and 13,800 of 3 tons and over; 38,000 cars; 7,000 station wagons, and 116,000 buses.

President Eisenhower's bid for another half-cent increase in the Federal gasoline tax to help finance work on the interstate highway system is getting a cool reception in Congress. Also opposed are highway users and petroleum companies.

The General Services Administration has reported its intent to buy another $771,618.14 worth of trucks and station wagons for Federal use. The order covers 489 trucks of various sizes and three station wagons. The entire order will be filled by Chevrolet. The vehicles will be delivered to various government locations throughout the U. S.

Circle 150 on Inquiry Card for more data →



Research and Development at Work

The Breath of Death! Tiny bubbles seeping up through a liquid. The tell-tale breath of death that Midland-Ross engineers have purged from Midland brake systems. One more decisive step in research and development at Midland-Ross that protects automotive America.

MIDLAND-ROSS CORPORATION

OWOSSO DIVISION OWOSSO, MICHIGAN

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AIR BRAKES · AIR COMPRESSORS · AIR CONTROLS · VACUUM POWER BRAKES · DIE CASTINGS · CONSOLIDATED TRANSPORTATION EQUIPMENT

Superhighways start here

After the planning's done, it takes "axle action" to get America's huge road-building program under way. Rugged, powerful action by thousands of axles on heavy equipment working 'round the clock . . . through all types of terrain . . . frequently subjected to overloads. To minimize costly axle shaft failures, use U.S. Axle Shafts. Finest alloy steels, precision-made by exclusive U.S. processes, guarantee "*extra-duty*" durability . . . reduce maintenance . . . protect your profits. Build *and* replace with the toughest, longest-lasting axle shafts on the market—U.S. "Extra-Duty" Shafts!

Get exact U.S. replacements for every vehicle through your jobber — or contact us for custom-engineered original equipment shafts.

FREE: Valuable booklet, "Causes and Prevention of Axle Shaft Failure" — send for yours today!

THE WORLD TURNS ON U.S. AXLES

THE US® AXLE COMPANY, INC.

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Circle 152 on Inquiry Card for more data →

precision boring–*New Britain's new approach*

New Britain Cam Actuated Vertical Precision Boring Machines offer an entirely new principle for more accurate boring and turning, plus compact exterior design and fast tooling. Rough cuts and finish cuts within close tolerances on the same set-up are characteristic. Standard models are available with maximum swing from 12″ to 17¾″ in 10 or 15 horsepower.

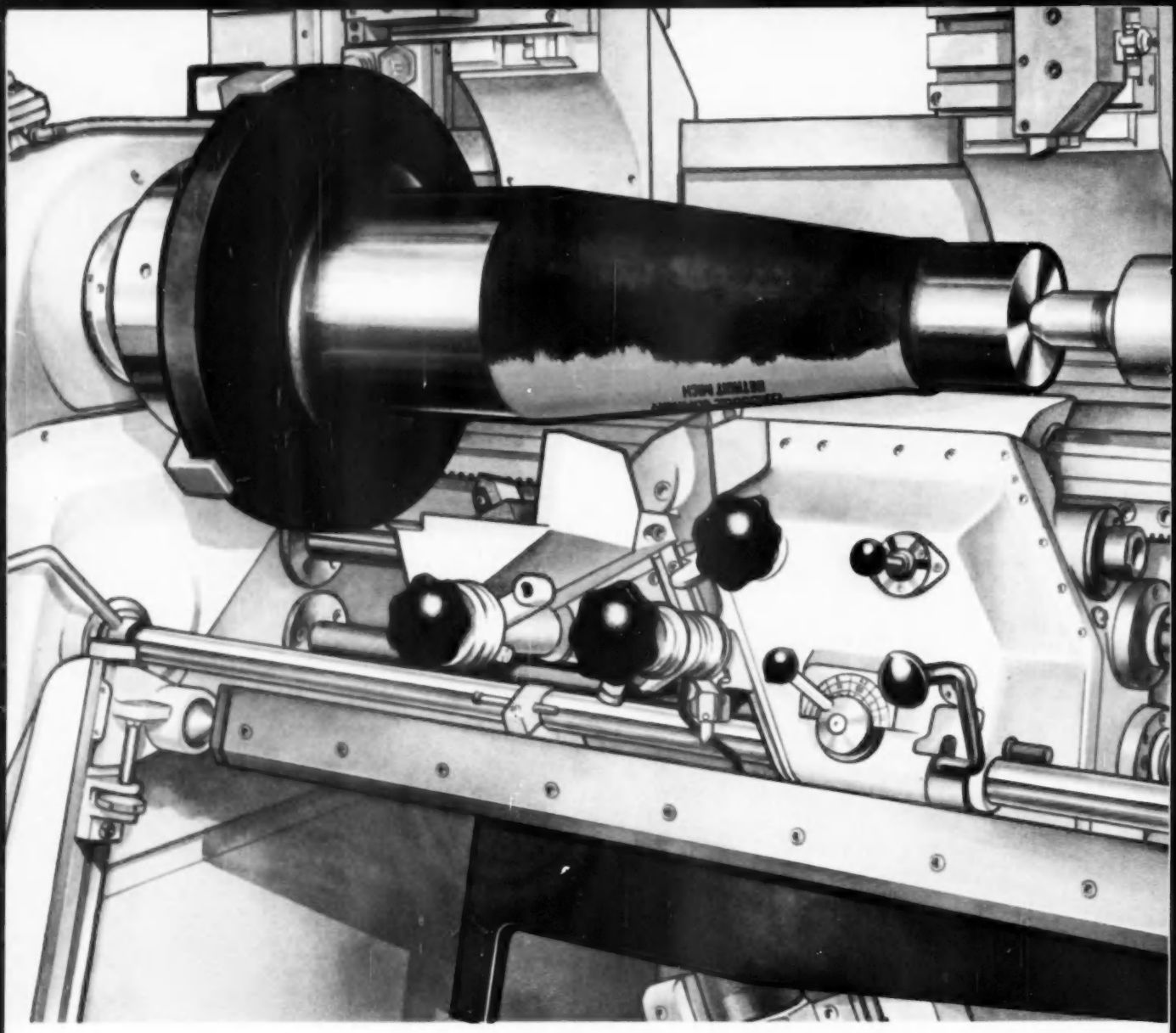
Here are a few of the major new developments incorporated in these unusual machines.

Greater accuracy. Both the vertical and cross slide cams are mounted on a common shaft which is contained inside the vertical slide. The linkages found in conventional cam-operated contouring machines are eliminated. Both the vertical and cross slides ride on preloaded roller bearings and are deflection-free.

Clean-sided design. Any number of these self-contained machines, each with one or more spindles, can be arranged side by side. Depending on how they are tooled, they operate either as a single unit or as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine, finishing both sides, completing *all* operations in one integrated, high-volume operation.

Fast tooling. Unrestricted accessibility allows rapid tool and cam changes.

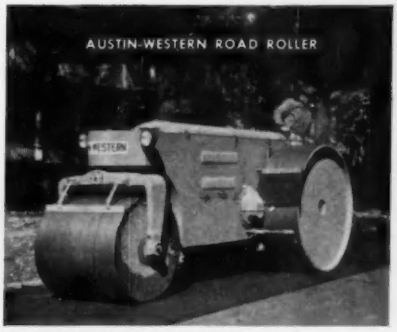
Complete catalog material is available. For your copy, write New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

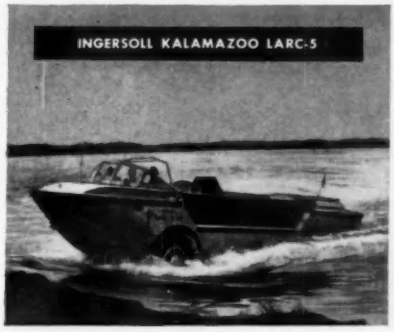


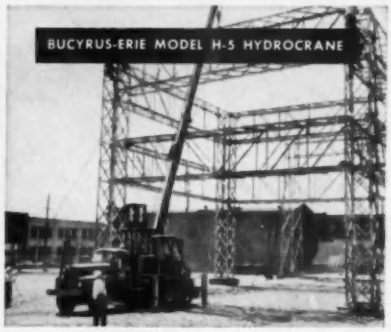
why a **copying lathe**–*why New Britain* **+GF+**

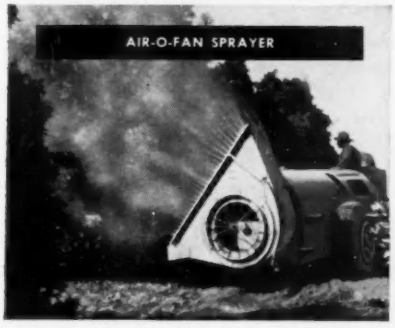
Beyond a certain point sustained production of the same piece on an engine lathe becomes uneconomical. Sometimes, however, the feeling exists that a copying lathe lacks flexibility, power and ruggedness or that it is just too "special." A New Britain **+GF+** has power–25 to 40 h.p. The **+GF+** has rugged design to handle big work and it's really flexible—a prototype or flat template will reproduce one or more pieces with fast, single point tooling. Whether it's shaft work or chucking work you have to do, ease of set-up is the same. The template or prototype can be changed in minutes. No special tooling set-ups are required, either. You can quickly switch from intricate cuts on slender shafts to heavy cuts on big castings or forgings (like the one shown). Complex profiling presents no problems even on jobs requiring really heavy metal removal.

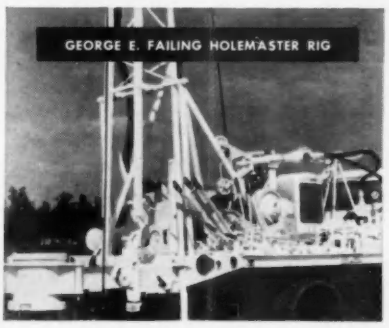
Fast set-up and changeover from one type of work to another is only part of the story. There's much more that you'll want to know about the New Britain **+GF+**. Watching one of these machines in action is the best way to get the whole story and we'd like to arrange a demonstration for you. If you'd like to look over catalog material, we have that too, of course. Write New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.











HERE'S WHY LEADING OEM's POWER WITH DEPENDABLE FORD INDUSTRIAL ENGINES

Spend a few minutes comparing Ford engines to this check list and you'll see why more and more original equipment manufacturers are swinging to Ford power.

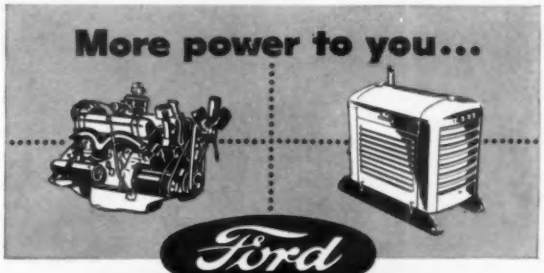
Durability and Efficiency! Ford's deep-block construction lessens engine vibration. Short-stroke design reduces friction and wear. Hard-faced, rotating valves provide better seating, mean longer valve life.

Compactness! Ford's compact design with high power-to-weight ratio allows greater freedom of design.

Parts and Service! Ford's world-wide dealer network (over 10,000 Ford Dealerships in U.S. alone) offers prompt, efficient service *wherever you go.*

Wide choice! Ford engines range from 134 to 534 cubic inches—including two highly efficient diesels. All are available as engine assemblies or power units.

Little wonder so many equipment designers, purchasing agents and sales managers are specifying modern Ford power for their equipment. Why not you?



FORD POWER IS RIGHT FOR YOUR EQUIPMENT, TOO!

INDUSTRIAL ENGINE DEPARTMENT, FORD DIVISION, FORD MOTOR CO., P.O. BOX 598, DEARBORN, MICH.

West of Rockies write to:
→ FORD INDUSTRIAL ENGINE DEPT., P.O. BOX 6787, LOS ANGELES 22, CALIF.
→ FORD INDUSTRIAL ENGINE DEPT., P.O. BOX 1666, RICHMOND, CALIF.

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COATED FABRICS
designed for the automotive industry
withstand gasoline

- *flexible*
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The Reevecote coated fabrics for the automotive industry have been designed and developed in collaboration with automotive engineers. The Reevecote line of natural and synthetic rubber coatings on a variety of fabrics is the most complete source of coated materials available to the industry today. Among the many uses for Reevecote are:

Air seals	Vacuum booster diaphragms
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Vapor barriers	Insulation
Pulsator diaphragms	Transmission modulators

Full research and development facilities are available for new applications, backed by the skills and knowledge of fabrics and coatings that only Reeves Vulcan can supply. Whatever your requirements, specify Reevecote and be sure.

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Circle 154 on Inquiry Card for more data

Manufacturers' News

Ford Glass Research

Ford Motor Co. plans a new glass research and process development center. The facility will be located in the building now serving the Tractor and Implement Div.'s Detroit regional sales office and parts depot at 25500 W. Outer Drive, Lincoln Park, Mich. A new building to house the Tractor and Implement Div. is being built near Birmingham, Mich.

Deere's Leasing Plan

Deere & Co. has announced a nationwide plan worked out with Boothe Leasing Corp. that will permit customers to lease John Deere industrial tractors and equipment. The plan will operate through the John Deere dealer organization and will be limited to the company's industrial and commercial customers.

Tyson Bearing Expands

A $2 million expansion has started at the Tyson Bearing Co., Massillon, O., a division of SKF Industries, Inc. The expansion will enable Tyson to nearly triple current tapered roller bearing production. E. R. Briden, SKF president, said the expansion would be completed in July. It is the third at the plant in the last 18 months.

Merger Talks Held

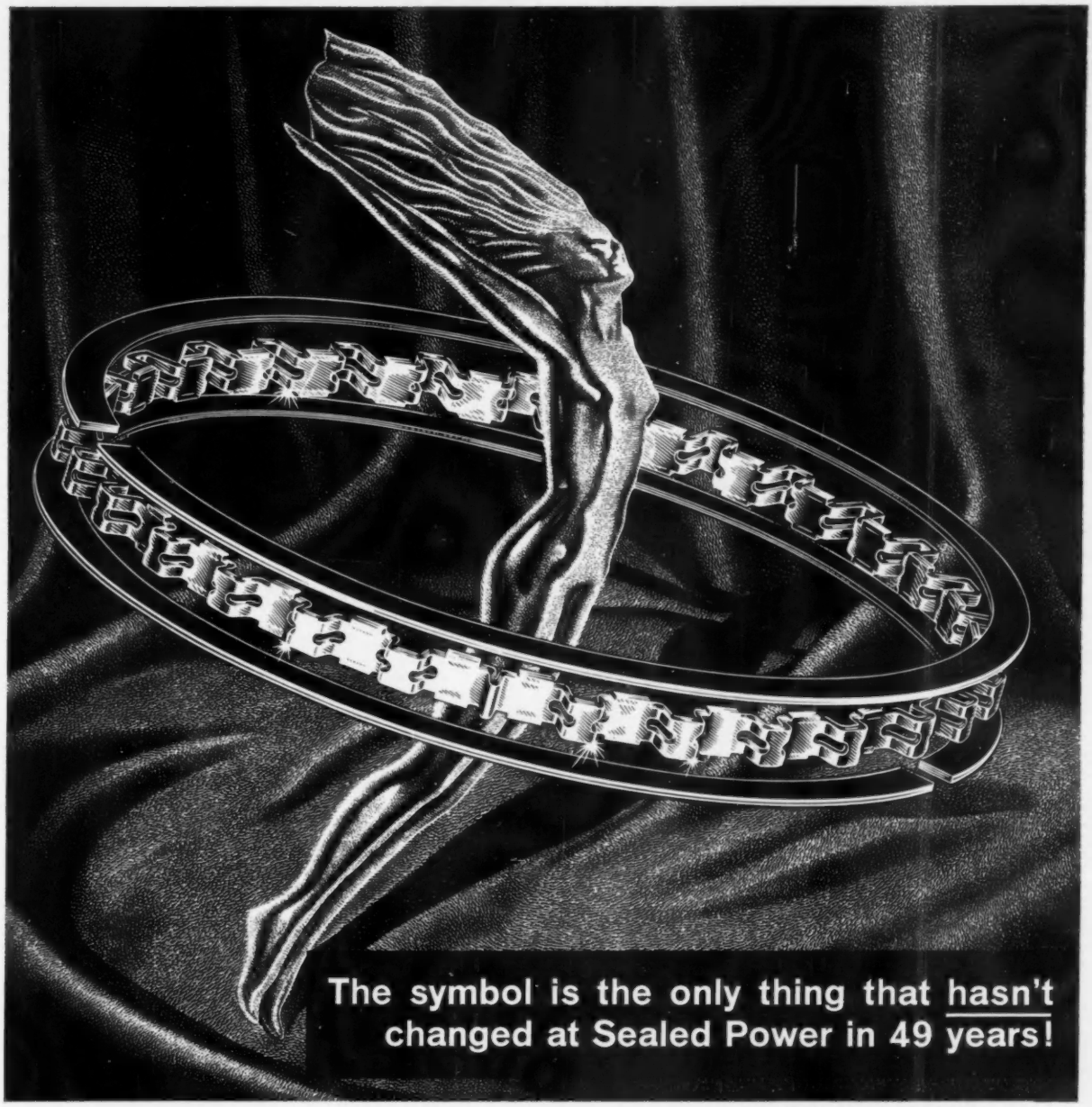
Discussions are being held toward possible merger of the Eaton Mfg. Co. and American Metal Products Co. It has been proposed that Eaton issue three shares of its capital stock for every four outstanding shares of American Metal Products. John C. Virden, Eaton chairman and president, and A. M. Mras, American Metal president, said the talks will continue.

Further Diversification

In a move for additional diversification, Minneapolis-Moline Co. has purchased the John Morrell Mfg. Co., of Elgin, Ill., makers of electric fork lift trucks. J. Russell Duncan, president, said all materials handling machinery manufactured by the corporation eventually would be sold under the Morrell name. The company recently received a Navy contract for $3 million in tow tractors and lift trucks. Morrell builds both electric motorized hand fork lift trucks and several sizes of counter-balanced "sit-down" type electric trucks.

Dow Plans Dutch Plant

Plans for construction of a styrene-butadiene latex plant in Rotterdam, The Netherlands, have been announced by C. B. Branch, president of Dow Chemical International Ltd., S. A. The plant, which will cost $2 million, will be built and operated by Dow's Dutch subsidiary at the site of its present terminal and warehousing facilities in the Third Petroleum Harbor at Rotterdam.



U. S. PAT. NO. 2,789,872 STAINLESS STEEL OIL RING

Sealed Power has walked (and sometimes run) along the pathways of progress with the reciprocating engine industry for virtually 50 years.

Through one significant era of development after another our engineers, our metallurgists, and production specialists worked with engine designers.

We measure our progress in terms of our contributions to the advancing efficiency of the internal combustion engine . . . to refinements in piston ring design . . . to the high performance standards so rapidly attained in sealing and transmission rings.

Your future is our future. We look to it in this way.

Our research programs, the talents of our engineers, the forward steps in manufacturing—all these are presently, and will continue to be, dedicated to our common cause.

Sealed Power

Preferred Performance

SEALED POWER CORPORATION, MUSKEGON, MICHIGAN • ST. JOHNS, MICHIGAN • ROCHESTER, INDIANA • STRATFORD, ONTARIO • DETROIT OFFICE • 7-236 GENERAL MOTORS BUILDING • PHONE TRINITY 1-3440

PISTONS • PISTON RINGS • SLEEVES • SLEEVE ASSEMBLIES • SEALING RINGS FOR ALL APPLICATIONS

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(Advertisement)

ADAMS FACT FILE #2

PLANT AIR

Moisture Chief Cause of Trouble . . .

Every company today is looking for ways to offset the increased costs of labor, material, equipment and services. At a gasoline station you expect "Free Air", but in industry it is a major expense. Perhaps in your own plant, for an investment in a few minor compressed air system alterations, significant savings are possible.

Water, sludge, rust, oil and dirt in compressed air systems are prime causes of maintenance and production down-time. Water vapor condensing in air lines tends to corrode the piping. Also, water present in the piping may freeze during winter, causing serious reduction of compressed air supply. Such restrictions are often difficult to locate and thaw. This same line moisture may emulsify lube oil destroying its lubricating value and the resultant mixture has high fouling characteristics. Frequently, ice will form within the tool itself since expanding air cools the moisture . . . tool efficiency will be seriously affected.

Some of the Other Problems Created By Wet Compressed Air . . .

Wet compressed air is not only a construction and production tool problem. Faulty paint jobs, contaminated chemical and food products can often be traced to moisture laden compressed air. Waterhammer, unequal pipeline thermal expansion and line leaks also result from collected moisture. In addition, air lost through traps, and in blow-down of compressed air lines provide no useful work . . . represent a sizeable power loss.

You Can Lick Compressed Air Moisture Problem . . .

All of these hidden costs can be virtually eliminated by the installation of an Adams Aftercooler and Cyclone Separator between the compressor and receiver tank. By cooling discharge air to within 10° F. of cooling water temperature — guaranteed with Adams standard Aftercoolers — the moisture can be removed at the separator. Pressure loss is less than one-half pound on these units including the separator. In severe cases, moisture removal of over 90 per cent can be obtained by cooling the air with Adams 2° Aftercooler to within 2° F. of water temperature.

Air Filter for Final Protection at Point of Use . . .

As an added safeguard for expensive tools and equipment, an Adams Poro-Stone Air Filter should be installed just before the air is used. These filters remove all solid material picked up by the air stream. With an Adams Aftercooler, Cyclone Separator and Air Filters clean, dry, trouble-free air is supplied to your production tools. You get continuous service with minimum maintenance.

For further information on how the complete line of Adams air equipment can solve your compressed air problems, write today for your free copy of Bulletin No. 712 on Aftercoolers and Bulletin No. 117 on Poro-Stone Air Filters from the R. P. Adams Company, Inc., 264 East Park Drive, Buffalo 17, New York.

Circle 156 on Inquiry Card for more data

Body Rust-Proofing and Final Assembly at CHRYSLER'S DELAWARE PLANT

(*Continued from page* 71)

controlled to a full minute, and solution temperature is maintained between 125 and 135°F.

The fifth stage takes the body out of the phosphating tank for a 50-sec drain and then through a 30-sec cold water rinse in the next tank and spray section.

Sixth stage is a chromic-acid-conditioner immersion and spray for a 30-sec period. This is at a solution temperature of from 140 to 150°F.

The body is subsequently drained, rinsed, and partially air-dried by blower, and then put through a drying oven for eight minutes at 350°F. In these latter operations, hot air jets are employed to accelerate and insure complete drying.

Following the hot drying, the body is taken through a 25-ft-long, refrigerated cooling tunnel where its temperature is brought down to 100°F ±10 deg.

The seventh and last "anti-corrosion" dip, considered to be the most effective, consists of immersion of the under portion of the body, to a depth of 18 in., in a tank which contains a gray-colored water-dispersed primer paint. This tank is equipped with both warming and cooling equipment for maintaining the solution temperature, under varying ambient temperatures, at about the same temperature as the incoming body, i.e., 100°F ±10 deg. The body is soaked in the primer paint for a minute and a half.

It then rises up from the paint and moves onto a drain deck. Here the prime paint is spray-washed off the exterior sides of the body because the finish paints will not adhere to this material.

Next, the body is put through the second "anti-corrosion" system oven, for initially curing the "undercoat." This is for a period of 15 minutes, and at a temperature of 200°F.

Preparatory to progressing to the finishing operations, the body is cooled down to room temperature and the primer paint further air-dried while the body is on an 810-ft-long conveyor for 30 minutes. During the cooling and drying cycle, sealers are applied.

The body then continues on the same conveyor line for seven exterior finishing operations. These start with two spray coats of epoxy primer paint; followed by oven-baking at 375°F for 30 minutes to complete the drying process for the water-dispersed paint, as well as to dry the epoxy prime paint. The body is then wet sanded; sprayed with two coats of enamel; and, finally, oven-baked at 250°F for 30 minutes.

Then, as one more—and the last—rust-preventive measure, the interior surfaces of sill panels below the doors are spray-coated with a high-melting-point wax to form an additional protective layer in this area. ■

Part II of this article, describing the final assembly operations at Chrysler's Delaware Assembly Plant, will appear in an early issue of AUTOMOTIVE INDUSTRIES

Spline Rolling of Tractor Axle Shafts

(*Continued from page* 77)

creased wear is the greater density of the grain structure and improved grain arrangement. Material is SAE 1046 steel with an average of 220 Brinell hardness.

The rolling process also resulted in the adoption of an involute rather than a straight-sided tooth form for increased strength. The increase in permissible torque loading (yield point) from the machined to the rolled shaft of the same OD is said to be actually over 60 per cent. Stress concentration has likewise been minimized. Contributing to the improvements is the ability to use full radii at the bottoms of the teeth wth the roll-forming process. ■

AUTOMOTIVE INDUSTRIES KEEPS YOU INFORMED

in this zone, stainless steels that remain ductile with high strength and stability

In the search for favorable strength-to-weight ratio, high temperature alloys have been developed with extreme strength up to 1000 F, but at the expense of ductility.

In AM 350 and AM 355, Allegheny Ludlum's precipitation hardening stainless steels, you have high hardness and stability from room temperature to 1000 F, plus almost twice the ductility!

These advantages are followed by easy formability using normal techniques. AM 350 and AM 355 can be brazed and welded as easily as the common stainless steels. They can be spun, formed and machined without special preparation.

AM 350 is available commercially in sheet, strip, foil, small bars and wire. AM 355, best suited for heavier sections, is available commercially in forgings, forging billets, plates, bars, wire, sheet and strip.

For further information, see your A-L sales engineer or write for the new technical booklet, "AM 350 and AM 355." **Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Penna.**

661

ALLEGHENY LUDLUM

EVERY FORM OF STAINLESS . . . EVERY HELP IN USING IT

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TETRASEALS are rectangular-section rings that give high performance, low-cost sealing for most static and some moving applications. They're economical because they interchange with standard o-rings, use the same groove, require no special tooling . . . and meet extra-critical tolerances. Ask for new, informative TETRASEAL brochure.
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O-RINGS by Goshen are precision-molded from a wide range of natural, synthetic and silicone rubber compounds to meet today's advanced requirements. They're available in a complete range of AN, MS, SAE and JIC standard sizes plus non-standard sizes and special shapes. Ask for 16-page O-ring brochure.
Write, wire or phone
Goshen Rubber Co., INC.
2720 S. Tenth St.
Goshen, Indiana

Heat Treating of Fuller Transmission Parts

(*Continued from page* 69)

before grinding and finishing.

With modern heat treating furnaces, many equipped with fully automatic process controls, and with the proper fixtures for loading and the most efficient quenching oil, we have reduced parts distortion to the minimum. We use a single quench oil for all furnaces and most parts. We have been using Shell Voluta Oil No. 23 for years, and have found that use of this oil has reduced distortion appreciably.

In the case of certain small and highly critical transmission parts, we employ marquenching (hot oil quench at 3000 F). For this process, we quench with Shell's Temp Oil 31.

Thrust washers which were previously ground after heat treatment are held to 0.002 in. flatness using improved fixtures together with Shell Voluta 23.

Our furnace installation includes two Surface Combustion's, four Leeds & Northrup Homocarb's, six Ipsen two-zone's and one Ipsen single zone. One Surface Combustion is a three-row pusher furnace treating 750 lb per hour to an effective case depth of 0.045 to 0.050 in. The other is a two-row pusher. We also have two liquid cyanide furnaces.

Each of the six Ipsen furnaces has capacity of 1275 lb per zone. The Ipsen's run a variety of parts from small thrust washers to large shafts. They are equipped with complete instrumentation for fully automatic control of temperature, atmosphere and cycling. They are also equipped with automatic loading and unloading facilities. We specify surface carbon content of 0.90 per cent on most parts treated in these furnaces. Ipsen furnaces offer the advantages of clean carburizing. Parts heat treated normally require no more than a wash-off of the quench oil before they are ready for service or further grinding operations.

Experience has convinced us that the production advantages gained through use of Voluta 23 include greater economy, more consistent core hardness and less distortion. We use it for straight hardening, cyanide quench, carburizing and carbonitriding. The oil is in use continuously, 24 hours a day, seven days a week.

Our Homocarb furnaces are used to treat the heaviest transmission parts, some up to 75 lb in weight. We can double heat treat in these furnaces, if necessary, for a very heavy case. Heating, including diffusion time, may be continued as long as 12 hours. In these furnaces, case depth will be up to 0.060 in., and surface carbon to 0.90 per cent. ■

Executives Read AUTOMOTIVE INDUSTRIES

Circle 158 on Inquiry Card for more data

Why Chrysler chose Purolator filtration for its new Valiant...

Purolator supplies both the air filter and oil filter for Chrysler's dramatic new Valiant. One important reason: Chrysler has proved that Purolator gives superior performance. • Compactness is another important reason. The Micronic® oil filter, for example, is more compact because Purolator puts lots of effective filter area into a small volume. It suits the Valiant to a T—permits more efficient use of the smaller space under the hood. • There are many other reasons why Chrysler chose Purolator filters, of course, and why it may profit you to investigate Purolator filtration. Just write and ask.

Filtration For Every Known Fluid

PUROLATOR
PRODUCTS, INC.
RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA

Circle 159 on Inquiry Card for more data

Mallory Contact Materials

can cut your costs

You get exactly the right contact performance you need from Mallory . . . at exactly the right price. And you pay *only for the performance you need* . . . never pay extra for contact properties not needed in your application. The reason: Mallory offers you 147 different contact materials to choose from—the widest range available. Each material is engineered to a different combination of operating conditions.

Mallory's metallurgical research has created materials covering the complete range of conductivity, hardness, strength, density, arc-erosion resistance and cost. Whatever your application, you'll find it served best within one of these groups of Mallory materials.

- Elkonite®—the most durable heavy-duty contact material. High strength and hardness, good electrical and thermal conductivity.
- Platinum Elkonium® and Palladium Elkonium®—corrosion-resistant alloys with low contact resistance; low contact forces.
- Silver Semi-refractory Compositions—highly conductive materials which maintain low contact resistance under heavy load.
- Tungsten and Molybdenum—materials with high strength and hardness, medium thermal and electrical conductivity.
- Copper and Copper Alloys—economical materials with high electrical conductivity. Available in cast or wrought forms.
- Silver and Silver Elkonium®—economical alloys with high electrical and thermal conductivity, low contact resistance.

Mallory contact engineers will be glad to recommend the materials best suited to your requirements. Write or call for a consultation . . . on contact materials, contact design, or contact fabrication by Mallory.

Mallory Metallurgical Company
Indianapolis 6, Indiana
a division of

P.R. MALLORY & CO Inc.
MALLORY

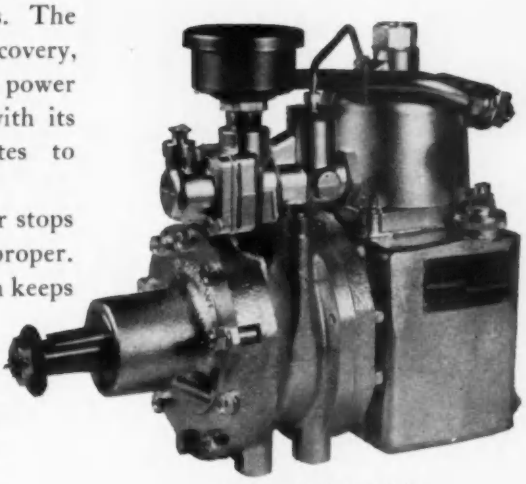
Circle 160 on Inquiry Card for more data

To provide *SAFER* stopping power...

Wagner Lockheed
ROTARY AIR COMPRESSORS
deliver ample air for safe operation of brakes

Trucks equipped with Wagner Lockheed Rotary Air Compressors always have plenty of air for safe, sure stops. The time-proven rotary action contributes to rapid pressure recovery, assuring ample air reserve. This means safer stopping power even under severe braking conditions. Rotary action, with its overlapping air compression impulses, also contributes to smoother, quieter operation of unit.

Pumping is regulated by a control valve which starts or stops compression by "loading" or "unloading" the compressor proper. This action establishes an intermittent pumping cycle which keeps reservoir pressure within the desired range.



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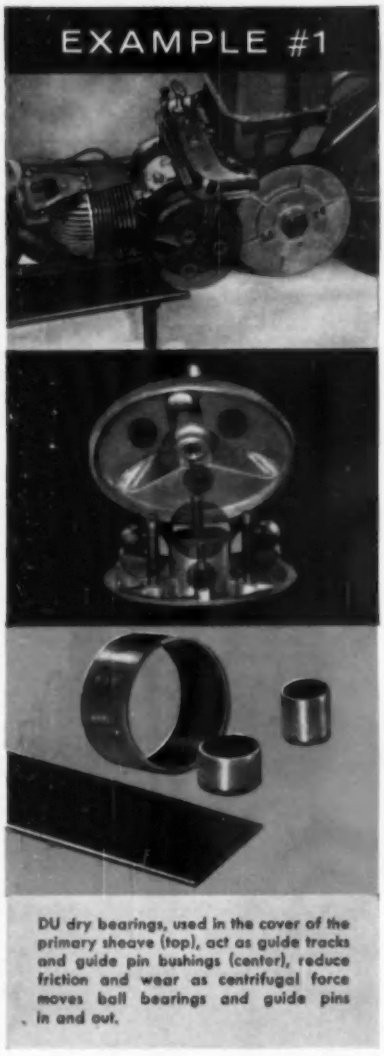

DU dry bearings, used in the cover of the primary sheave (top), act as guide tracks and guide pin bushings (center), reduce friction and wear as centrifugal force moves ball bearings and guide pins in and out.

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greatly improve transmission design of Harley-Davidson "Topper"

Used at vital locations in the transmission assembly, DU dry bearings reduce friction and wear to the absolute minimum on the latest addition to Harley-Davidson's fine motor scooter line. DU dry bearings solve another problem, too—the accumulation of dirt and grime in the transmission lubrication. DU material requires no lubrication whatsoever, and will last many times longer than other dry bearings.

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GARLOCK

*Trademark, Glacier Metal Company Ltd.

MACHINERY NEWS

(*Continued from page* 79)

While in process, the workpiece is positioned and clamped automatically. Altogether the machine performs 120 drilling, milling, reaming, spot-facing, chamfering, and tapping operations. Probes are provided at drilling and tapping stations—air gaging at one of the stations. In addition, proximity switches are provided to detect drill breakage.

Besides the machining stations, there are two automatic assembly stations—one for pressing in a bushing, and the other for assembling plugs.

Automatic lubrication is built in, with drilling and milling heads mist-lubricated. Soluble oil is employed, the system being rated at 200 gpm.

Employing 66 motors, the machine has a total of 230 hp in action; and its control system employs 683 relays, 234 limit and pressure switches.

The operator console includes some 310 neon indicating lamps arranged in the same relative pattern as that of the machine heads.

Despite the large variety of operations, this extensive setup can produce 180 pieces per hour at 100 per cent efficiency.

Around the Industry

F. Jos. Lamb Co.—Carl R. Lindell, former chief engineer, has been promoted to the position of plant manager.

Warner & Swasey Co.—Howard W. Geyer has been named general superintendent; and Peter Rusnov made chief industrial engineer. Lad J. Bayer is new general manager of the Control Instrument Div. which was recently moved to expanded manufacturing facilities in Flushing, L. I., N. Y.

Ex-Cell-O Corp.—James W. Hatch is rejoining the company as general manager of the Downey, Calif., plant. James W. Wolford will continue as plant superintendent at Downey.

Bendix Aviation Corp. — has produced a new 16-mm color mo-

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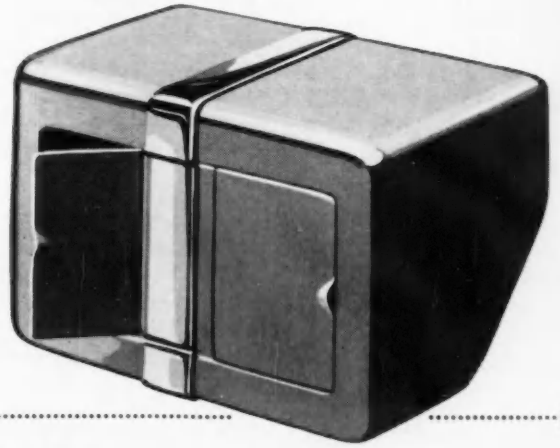

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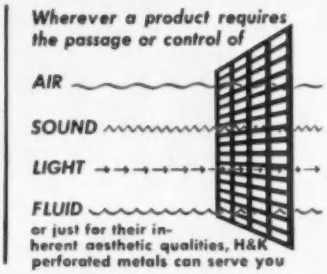

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tion picture film entitled "Numerical Control Manufacturing." The 22-minute film shows the advantages of numerically-controlled machine tools and how they are being used in typical applications. It is available from Industrial Controls Section, Bendix Aviation Corp., 21820 Wyoming Ave., Detroit 31, Mich. ■

Preventive Maintenance at Pontiac Foundry

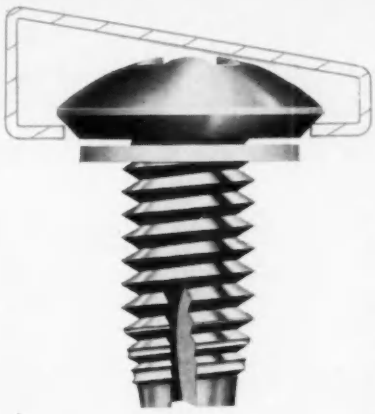
(*Continued from page 75*)

moved through molding and shakeout areas, they would frequently bang into the switches and break them off. To avoid breakage, limit switches were in most instances moved off the direct line of movement. They were rigged to free-swinging paddle actuators on the line. These actuators, touched by the flasks, nudge an overriding cam which actuates the limit switch.

A critical point in limit switch service life is bushing wear and this problem is also common to other areas in the system where there is heavy metal wear. Plant engineers are now recommending that all limit switches be equipped with steel bushings and chrome plated shafts.

As with any complex unit of heavy machinery, there is a natural tendency to add controls and safety interlocks as experience is gained in the use of the equipment. However, with the combining of several operations and the elimination of several pieces of equipment and their electrical controls, Line No. 1 is now controlled by some 120 limit switches or safety interlocks. These limits are presently all controlled from a single control box which causes some difficulty in getting at shorted lines and in readily identifying which segment of the line is causing trouble. As a result, separate junction and control boxes are being set up for the shake-out area (refer to Fig. 1).

This area is now kept under constant surveillance by a maintenance man, and the boxes will be so positioned that this same man can observe the control panel. Some departmentalization of electrical



how much did Philco save per unit with this Shakeproof idea?

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Ideas like this are important to you whether you make refrigerators or not. This one is typical of Shakeproof ingenuity in research and development that daily creates new ideas for industry . . . ideas to improve product performance, to speed assembly operations, to lower total costs. It represents the kind of creative engineering characteristic of Shakeproof designers and engineers who are available to visit your plant, to study your assembly methods and problems and to design ingenious new fastenings for your specific application.

The idea that is saving money for Philco is the Shakeproof® Trim Mounting Thread-Cutting Sems designed so that decorative molding strips can be snapped into place over the fastener. This eliminates a previous three-part fastening operation and the related disadvantages of locating and holding the bolt while the nut is applied from the opposite side. Shakeproof's Trim Mounting Sems cuts its own thread and eliminates the need for a sealant, too, as the nylon washer is drawn down tightly to serve as an effective sealer.

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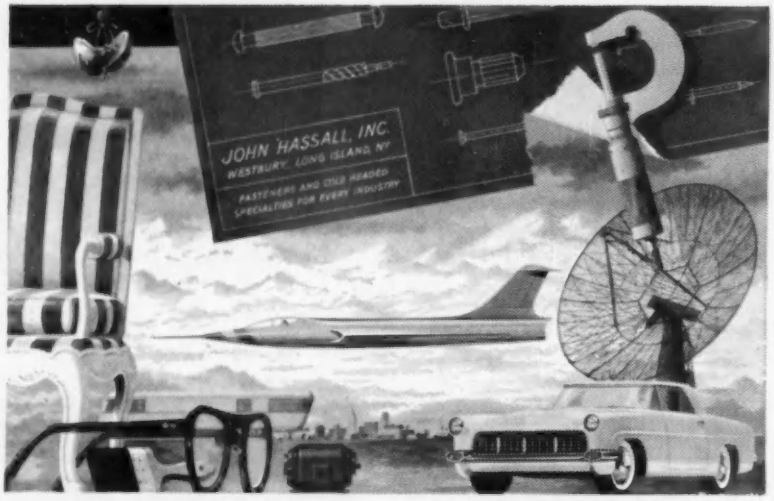

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control function is expected to result in a smoother functioning system.

Considerable readjustment has also been necessary in the mechanical handling system which brings the sand to the molding stations and returns it to the mixing and storage units (refer to Fig. 1).

Sand is returned from the shakeout stations via a basement level vibrating shaker. It is passed from this shaker to a hex screen which rotates slowly, separating sand from scrap iron, etc. In the section of the shaker immediately before the hex screen, a double level vibrating screen was installed. The top level had holes punched in it, allowing sand to fall freely to the lower level, and retaining scrap subsequently discharged to a refuse area. It was found, however, that scrap was jamming the holes, causing sand to gather around the projections on the lower level. Feed to the hex screen was often incomplete, and occasionally the shaker would stop altogether because of clogging. This elaborate double screen was unnecessary. It was found that sand and scrap could be passed successfully directly into the hex screen for separation.

The drive which gives the shaker its motion also created a problem. The motor drive functions at approximately 1800 rpm, imposing a thrust on a rubber bushing, which gives the shaker its vibratory motion. Electrical controls for this operation are attached directly to the motor drive. Plant engineers found that while the motor drive maintained its 1800 rpm, the rubber bushing sometimes did not impose a corresponding thrust against the shaker. Thus, the shaker could come to an almost complete halt, while the drive was still operating at full speed. Sand would pile up on the conveyor, occasionally to such thickness that the whole system had to be shut down while maintenance men hand-shoveled sand from the clogged conveyor.

After checking a number of sources and finding none which could offer a way of monitoring this condition, Pontiac devised what it calls a "zero ratchet switch." This instrumentation consists of a ratchet actuated by the movement of the shaker itself. The

SILICONE NEWS from Dow Corning

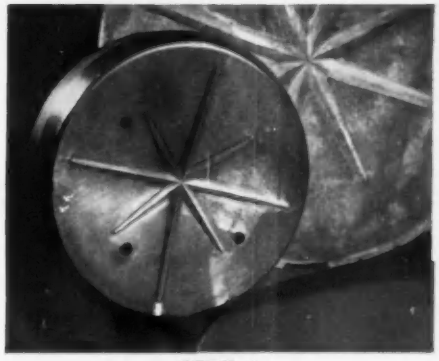
Easier Way to Make Prototypes

↑ STEP 1

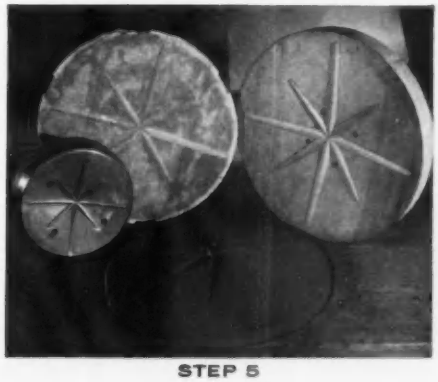
STEP 2 →

Case History: Making Hub-cap Embossing Dies

STEP 3



STEP 4



STEP 5

SILASTIC RTV SILICONE RUBBER Molds Strip Fast and Easy

Silastic® RTV, the Dow Corning liquid silicone rubber that vulcanizes at room temperature, provides a new and better way to make prototype parts. This fluid rubber is easily poured into, over, or around complex shapes, and sets up in a short time. The result is a strikingly accurate mold, into which you can pour many casting materials such as plaster, waxes or plastics. Because Silastic RTV will withstand temperatures up to 500 F, many molten metal alloys can also be cast. Silastic RTV strips readily from most materials without loss of pattern detail. Here's how one automotive industry supplier — Cadillac Stamp Co. — uses Silastic RTV to make templates for hubcap embossing dies.

Step 1. A wood pattern was machined to the exact configuration of the hubcap design. The intricate design requires a material that releases easily without loss of detail. Silastic RTV has been poured on the pattern to make a "negative" mold.

Step 2. The Silastic RTV mold is then used to cast a plastic. A "positive" image that faithfully reproduces the original pattern results. This image forms a template or prototype from which a pantograph-type engraving machine can sink dies.

Step 3. Now we return to the rubber mold, and this time more Silastic RTV has been poured into it. A rubber "positive" results. The two rubber molds release readily and two exactly matching parts result.

Step 4. From the rubber "positive", another plastic image is cast. Silastic RTV strips off easily . . . a crucial factor. The second plastic template is now ready for the engraving machine to sink dies. Size is reduced by one-half in the process. Note size of finished hubcap.

Step 5. Here are all the steps reassembled. Remember — both embossing dies were made from one wood original, thanks to Silastic RTV. Throughout the process there has been no loss of pattern detail . . . and exactly matched dies have been made.

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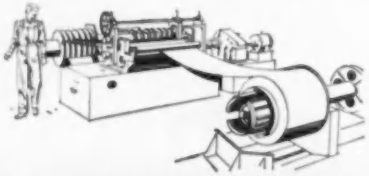

ENGINEERING YODER MANUFACTURING ROTARY SLITTING LINES

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ratchet, in turn, activates a zero switch. The zero switch is pre-set to operate at a certain rpm from the ratchet. If the ratchet does not operate the switch at the prescribed rpm level, the whole sand system is immediately shut off by the zero switch. This gives an immediate positive check against sand accumulation because of conveyor drive failure.

As sand moves into the hoppers and to the mixers before molding, it passes among cutter bars which break up lumps of sand and prevent any large foreign particles from passing through. These cutter bars are steel rods approximately ¼-in. diameter spaced about 1 in. apart. Originally these bars were lined up and vibrated in a perfect horizontal plane. Slightly moist sand could easily clog up the openings between the bars. By lowering every other cutter bar at a slight angle, the clogging problem was solved.

One of the biggest continuing maintenance problems on the whole line was in the skin drying oven, where drag molds were baked free of moisture prior to closing with the cope. Bearings, sprockets and chains in this section were operating under constant temperatures of 250 to 300 F, creating problems in wear and erosion. Maintenance had to wait until the oven cooled down, requiring lengthy shut-downs of the whole production line. This oven has been eliminated from the line through the use of an automatic sprayer which applies to each drag mold a carbon drying agent in a hydro-carbon carrier. No heat is necessary to achieve the dryness necessary to make a perfect casting.

Some adjustments have also been made in the sand filling hoppers over cope and drag molding machines. Hoppers were originally constructed of mild steel, and were subjected to corrosive attack by the sand. Resultant pitting allowed accumulations of sand to build up on side walls, causing uneven filling of flasks. Hoppers have now been converted to stainless steel construction. Square corners have also been rounded off, and leaves added to the sides of the hoppers to prevent sand accumulation.

To reduce downtime, a number of changes have been made in the flask handling system. Flasks are moved to and from work stations by cylinders, in most cases powered by plant air at 90 to 95 psi. Air cylinders, however, have been replaced by hydraulic cylinders at four key points in the system movement, reducing downtime and scrap.

As the poured mold leaves the cooling conveyor, it moves into the stripper, where the cope is separated from the drag. An air cylinder had been used at this point to push the flask into the machine. It was found, however, that frequently hot metal would spill over the edge of the flask, causing the flask to hook or even fuse temporarily to the actuating arm. Air pressure would build up, and then abruptly push the mold into the station with terrific force. As a result, the flask often overrode the stop, shearing limit switches, etc. To avoid the sudden burst of pressure, a hydraulic cylinder was installed which builds up the pressure more evenly. This cylinder operates at 300 to 400 psi. Three hydraulic cylinders are used in succession in the stripper—shake-out area. The last of these three is perhaps most important. The hydraulic cylinder moves the cope into the idle station immediately preceding the cope turn-around. A cope which "shoots" through the idle station too fast can block the swinging action of the turn-around, damaging flasks and shearing turning pins. Another hydraulic cylinder is now being used at the point where the completed mold is put on the conveyor before pouring. Hydraulic power is used here so that core assembly tolerances held by cores will be constant.

The actuating cylinders posed another problem. In the extended position, some cylinders have strokes of 5 ft. In the extended position this can cause the cylinder to depress and catch on a projection of the flask. This not only caused jam-ups on the system line, but mis-alignment of cylinder arms. A system of rigid steel trolleys was devised which ride as a carriage beneath the cylinder arm as it pushes a flask to the next station. This simple device has now been installed on all cylinder arms in the

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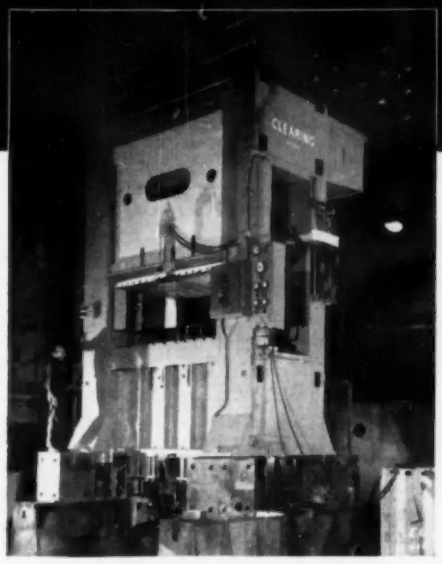

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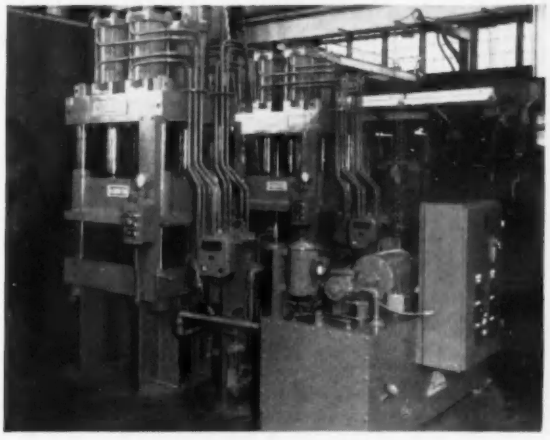
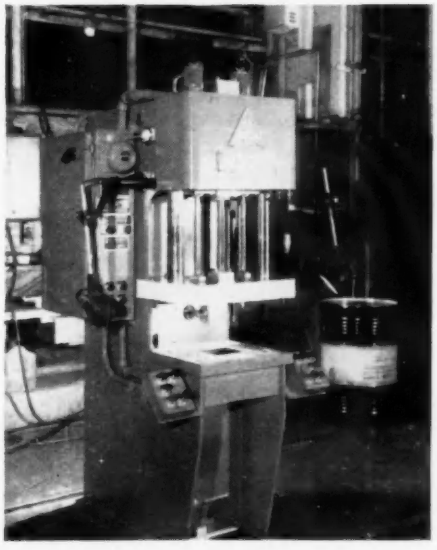


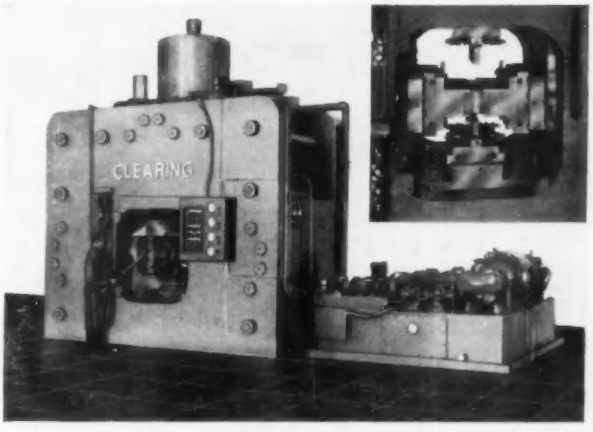
BOWLING BALLS—*MOLDING*

These two steam heated, 200 ton column-type hydraulic presses are designed for multiple cavity molding and operated from a single power source.



DIE CASTING—*TRIMMING*

High speed trimming is done on this 10 ton hydraulic gap press.



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system.

A considerable amount of pipe breakage was also being experienced on the air and hydraulic cylinder feed lines. As the cylinder moves forward and back, it sets up a natural vibration. This vibration has its greatest effect at the point where feed lines enter the cylinder. At this point the thin piping supports the whole cylinder. To absorb this vibration, the last six inches of the feed tube has been replaced with a Neoprene hose or nipple. The nipple acts as a shock absorber and has substantially cut down on broken cylinder lines.

Another engineering change, worked on in conjunction with Osborn Manufacturing engineers, has resulted in a simplified machine operation which contributes substantially to reduced maintenance. In the original line, cope molds emerged from the cope molding machine, moved to an idle station, to a rock-up inspection station, to an idle station, and then in a raised position, into the close machine. The drag then moved up to the cope, and the completed assembly came down to the original drag conveyor level and moved to the pour area.

Two factors made a change desirable in this area. For one thing, because of the smooth functioning of the line and its excellent program of preventive maintenance, rock-up inspection of the cope was deemed unnecessary. Secondly, any unnecessary vibration of the cores after they have been set may throw out tolerances on the completed engine block. The earlier close machine had two improvements: the drag moving into the cope from underneath, and the completed mold moving back down to the main conveyor. Now the cope moves from the molding machine directly into the close machine, with the cope in an elevated position. When the drag has moved into position, the cope is lowered on top of the drag and closing is completed in one motion. In this way, joining of cope and drag is accomplished with a downward push, always more easily controlled and involving less jarring than an upward thrust and then a downward movement.

Revised materials specifications on certain machine components have also contributed to increased hourly production runs. It was found that excessive wear was occurring on the center post upper bearings, turret lift collars and flat seal turret bearings of the cope and drop molding machines. Originally these components involved wearing of 1020 SAE against phosphorous bronze. These components are now chrome-plated, wearing against meehanite cast iron, and in three years have shown no effects of wear.

In general, the problem which Pontiac is solving on preventive maintenance in a modern foundry is establishing a smooth functioning relationship between pneumetically and hydraulically powered heavy duty machines, and materials handling equipment, controlled by delicate, sensitive switches and interlocks, in an atmosphere where sand and water is a constant threat as a circuit breaker and corrosive agent. ■

Hydraulic and pneumatic lines are quickly and easily connected with Hansen Two-Way Shut-Off Couplings. No tools required.

When Coupling is disconnected, valves contact valve seats in both Socket and Plug to provide instant and positive seal of fluid in both ends of line. Coupling does not depend upon line pressure to seal either end of line.

Six sizes are available, with female pipe thread connections from 1/8" to 1" respectively. Furnished either in steel or brass.

Representatives in Principal Cities ... See Yellow Pages

Instantly shuts off both sides of line... prevents loss of liquid, gas or pressure.

Quick-Connective Fluid Line Couplings for

COMPRESSED AIR • OIL
GREASE • HYDRAULIC FLUIDS
WATER • VACUUM • STEAM
OXYGEN • ACETYLENE
REFRIGERANTS • GASOLINE
COOLANTS • LP-GAS

Write for the Hansen Catalog

Here is an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes and types of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings.

SINCE 1915 — QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 35, OHIO

When They Compare for

Clutch Torque Retention

...Fleet Operators Switch to LIPE!

Torque retention is an important matter to the steadily growing body of fleet owners who are changing over to Lipe. Their every-day experience tells them that Lipe Heavy-Duty Clutches mean *more* miles per gallon of fuel . . . *more* ton-miles between shop-stops . . . *more* capital-equipment-use per repair dollar. All because of Lipe's high retention of torque capacity. Why argue with these practical men? Give them what they want: Lipe Heavy-Duty Clutches, either as original or optional equipment. Let their growing numbers prove to you that *the trend is to* LIPE!

Lipe Heavy-Duty DPB Clutches are available in single and two-plate types; 12", 13", 14" and 15" sizes; with torque capacities from 300 to 1900 ft.-lbs.

Lipe-Rollway Corporation
Syracuse 1, N. Y.

Circle 175 on Inquiry Card for more data

Look – TERRA-TIRES roam through 12-inch mud!

Photo taken through the courtesy of Crain Brothers, Grand Chenier, La.—builders of the "Marshbuggy"

This strange vehicle is called a "Marshbuggy" – and it rolls through some of the mushiest, muddiest marshland in the world on Goodyear's famous Terra-Tires. Try wading through this Louisiana swamp and you'd sink knee-deep in oozing mud. And the stuff is so sticky that it clings like wet paste. Yet Terra-Tires are at home in these treacherous bogs – often carry cargoes weighing up to 4000 pounds *in addition to* the weight of the buggy. This amazing flotation gives Terra-Tires the ability to "go anywhere" – up rough, rocky grades – over soft, shifting sand – even through powder-fine snow. What's the secret of this remarkable mobility? Low inflation pressure – low rolling resistance – great flexibility and surprising strength. Can Terra-Tires solve a mobility problem for you?

DESIGNERS: *By designing vehicles from the start to utilize the unique engineering advantages of Terra-Tire transportation, substantial savings in space and weight can be realized. For more information, write Goodyear Tire & Rubber Company, Aviation Products Division, Dept. M-1732, Akron 16, Ohio.*

Look where Terra-Tires are working right now!

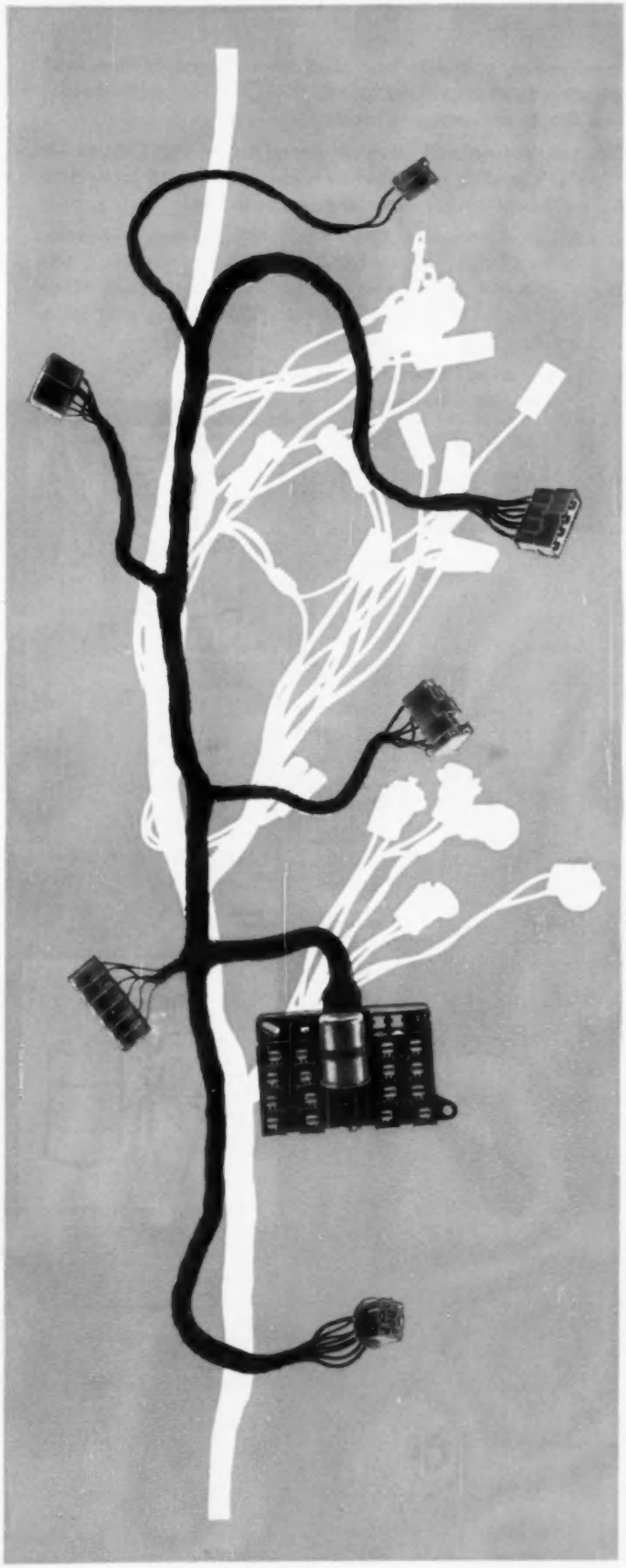
Bringing bananas out of marshy groves.

Carting golf equipment without harm to greens or fairways.

Cleaning sandy beaches without sideslip.

GOODYEAR

Terra-Tire—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio



Packard Wiring Systems

SAVE ASSEMBLY OPERATIONS!

Packard Electric engineers strive continually to make their products less expensive and faster to install. Now they have made it possible for the already efficient automotive wiring harness to become an even more complete sub-assembly. • For example, the dome light of the Corvair is attached to the wiring harness at Packard and shipped ready to snap into the roof of the car along with the wiring. Single terminals are replaced by "Snap Fast" multiple connectors, fuse blocks and other cost-saving components. • If your present wiring harnesses do not include these advantages ask Packard Electric engineers to help work out modern wiring systems for you. Packard Electric, the world's largest producer of automotive wiring systems, has sales and engineering offices in Detroit and Chicago.

Packard | *Electric*

Warren, Ohio ← → GM GENERAL MOTORS

"Live Wire" division of General Motors

ALEMITE BARREL-TO-BEARING LUBRICATION

the "moving force" of production!

More and more, cost-conscious plant men are recognizing modern lubrication as an important "production tool." No longer do they see it as a simple maintenance problem.

With the years-ahead Alemite Barrel-to-Bearing Lubrication method, today's leading manufacturers are stepping up production . . . reducing downtime . . . extending machine life.

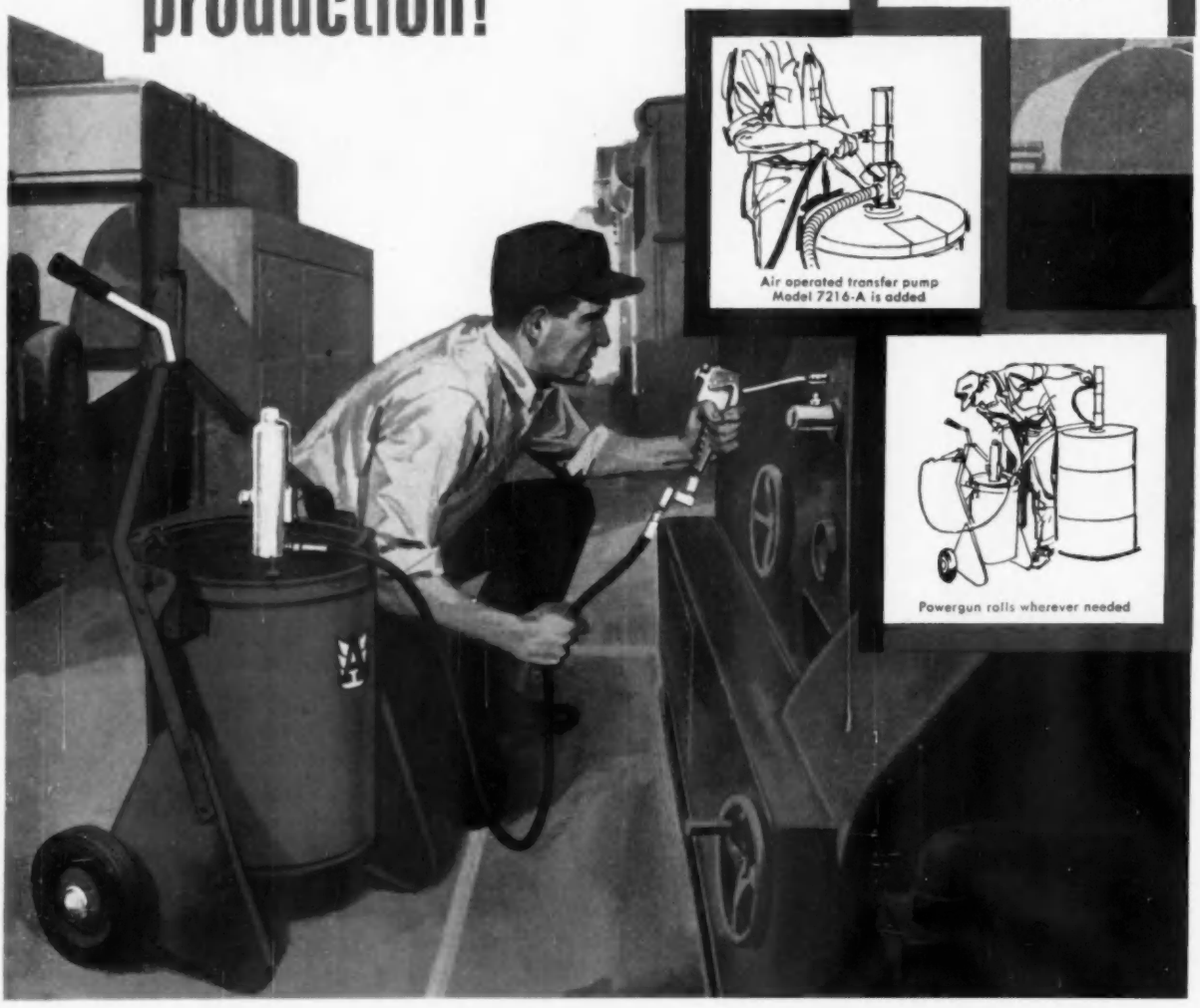
Included in a complete Alemite barrel-to-bearing lubrication method can be electric, air or hand-operated equipment. It will more than meet every need for high-pressure lubrication, filling hydraulic systems, servicing oil reservoirs, lubricating gear housings, and refilling grease guns.

Write for free Alemite catalog today!

Symbol of SW Excellence

ALEMITE
DIVISION
STEWART-WARNER
CORPORATION

Dept. U-20, 1850 Diversey Parkway, Chicago 14, Ill.



Cover protects 400 lb. drum

Air operated transfer pump Model 7216-A is added

Powergun rolls wherever needed

Circle 178 on Inquiry Card for more data

Stainless steel

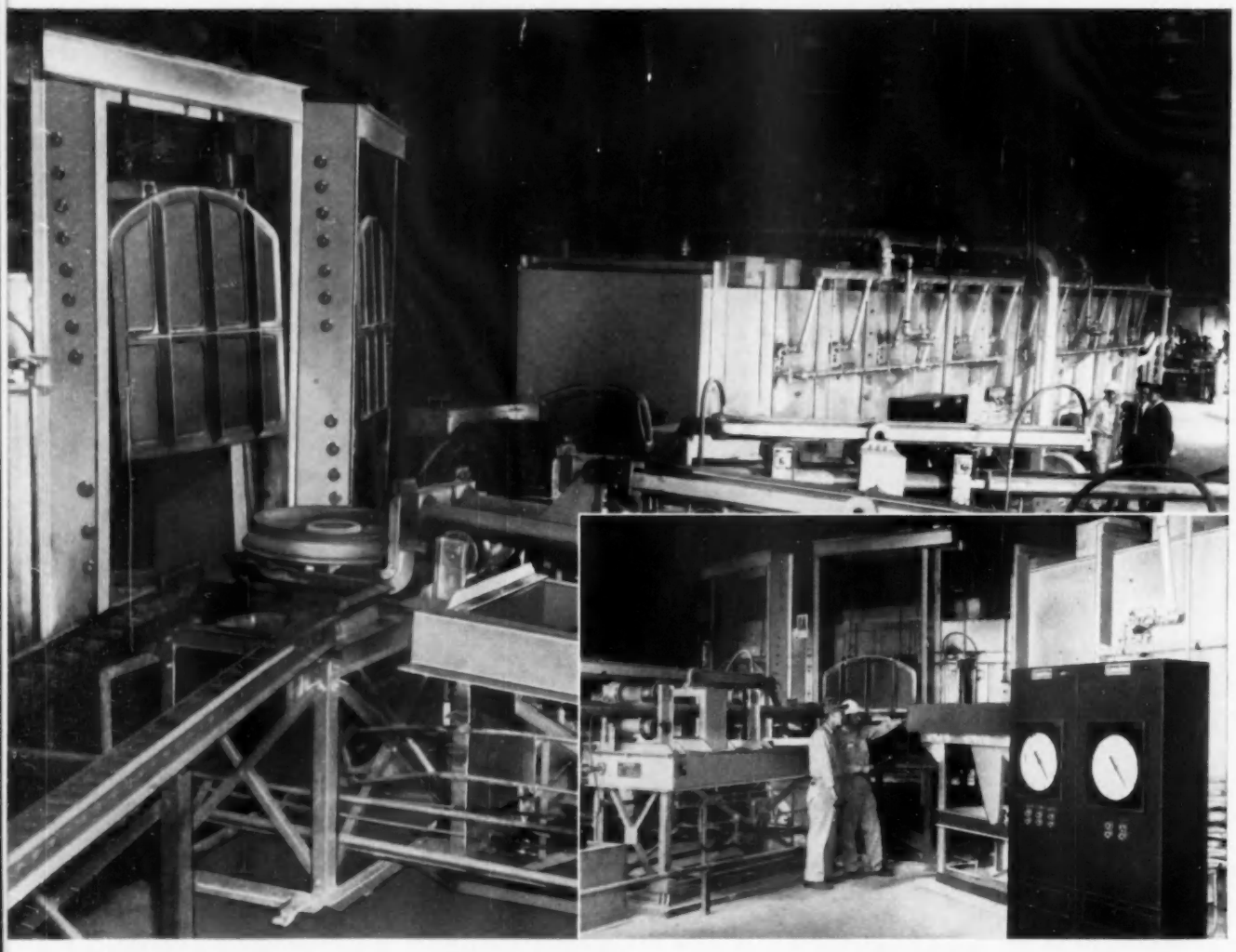
stands up to heat! Where other metals deform, weaken, or even melt — stainless steel stands up! What *else* is better about stainless? It resists corrosion, peeling and denting. And its beauty is more than skin deep — in fact, it's *solid* beauty! No wonder designers specify stainless when they want things to endure . . . beautifully. Chromium is what makes stainless steel stainless. And the very *best* stainless steels are made with Vancoram chromium products and other ferroalloys. Vanadium Corporation of America, 420 Lexington Avenue, New York 17, New York • Chicago • Cleveland • Detroit • Pittsburgh

VANADIUM
CORPORATION OF AMERICA
Producers of alloys, metals and chemicals

Circle 179 on Inquiry Card for more data

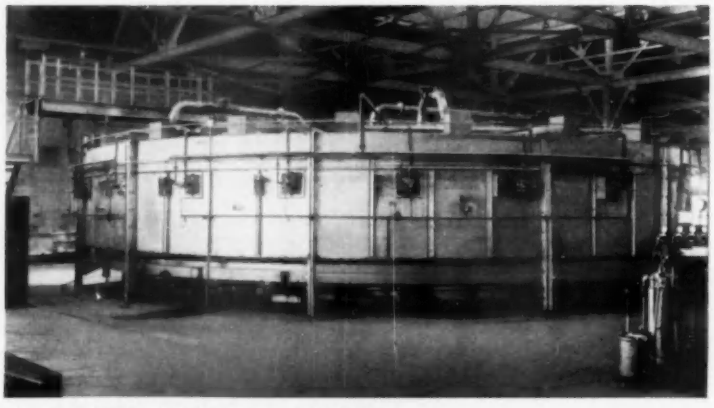
BIG JOBS ARE PART OF LINDBERG'S

Complete, automated heat treating installation at Griffin Wheel designed and installed



Several years ago, Griffin Wheel Company's plant at Colton, California began heat treating car wheels in a Rotary Hearth Furnace designed and installed by Lindberg Industrial Division. It was one of four similar installations at other Griffin plants in United States and Canada. Recently, when production at the Colton plant needed to be doubled, Griffin again called on Lindberg Industrial engineers to develop the necessary methods and equipment. The desired result was accompanied by a specially designed Preheat Furnace shown at the right above, engineered and installed by Lindberg Industrial and automated to work efficiently with the original Rotary Hearth Furnace. Inset shows the Lindberg control panels conveniently installed for operation of both furnaces.

The operation of both furnaces was completely automated. The above photo shows the charging of the Preheat Furnace and the automatic conveyor which moves the wheels through the Preheat Furnace and delivers them to the Rotary Hearth Furnace.



The original Rotary Hearth Furnace at Griffin has an outside diameter of 44'. Initial capacity of 13,000 lbs. per hour was doubled with the installation of the new Preheat Furnace.

FULL SERVICE

by Lindberg Industrial Division

A PLUS DIMENSION IN SERVICE TO USERS OF HEAT FOR INDUSTRY

Most everyone knows Lindberg as a builder of fine equipment for any industrial heating need. But there is a plus dimension to Lindberg's service that is available to any industry whose product requires heat in its making.

For such people we offer the complete designing, engineering, building and installation of the necessary equipment and facilities to process any product requiring heat—in the quality and quantity desired by its maker. This service covers broad requirements—plant layout and construction, when desired, complete, automated production lines or just specially engineered industrial heating equipment efficiently integrated into your production processes.

You obtain many advantages when you offer your industrial heating problems to Lindberg. You get the combined skills of what we believe to be the country's finest group of engineers and technicians in the industrial heating field, with many years experience in the solution of all types of "heat for industry" problems. You need give us only your end product specifications and you will get the installation, from one responsible source, guaranteed to achieve the results you need and ready to go to work at the turn of a switch.

Our experience covers the whole range of industrial heating methods so you can rely on us to recommend the processes most suited for your specific need.

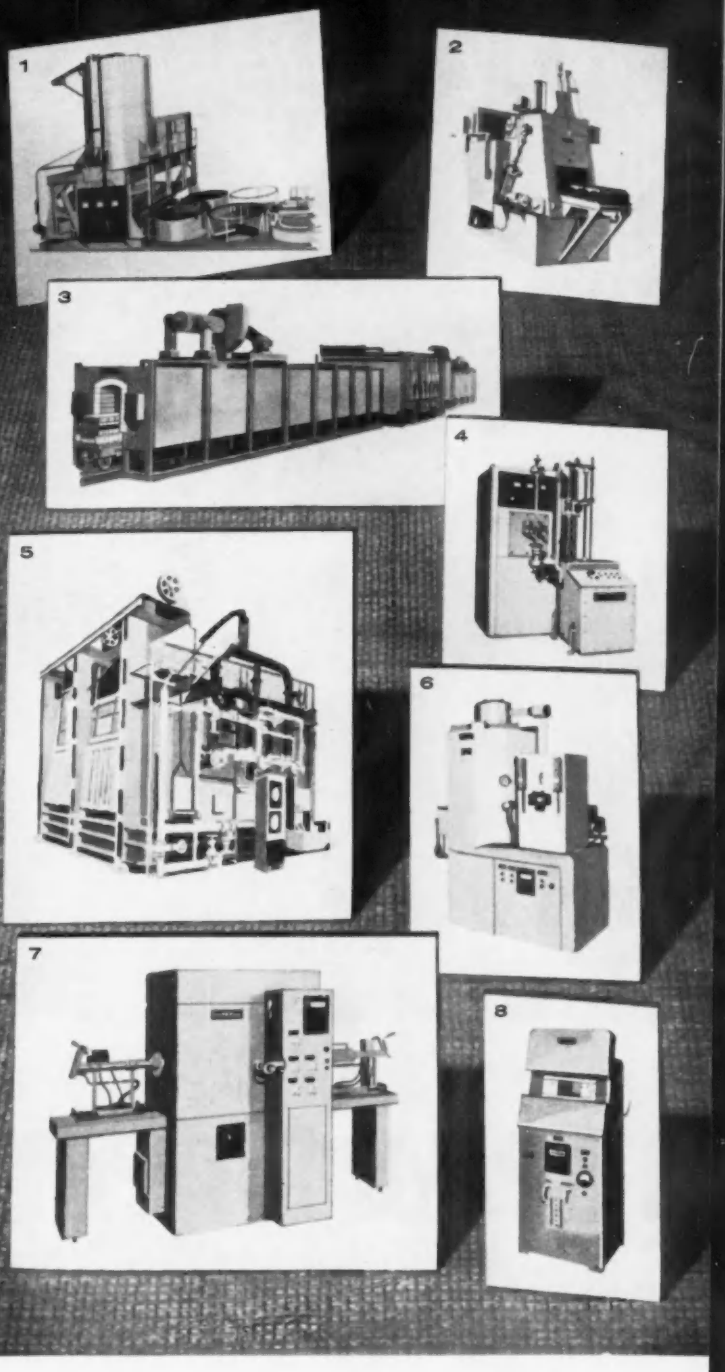
Whatever size your installation need be, no matter how rigid your quality specifications are, turn the complete job over to Lindberg. You'll be happy with the results.

Lindberg Field Engineers are available in 23 major industrial centers in this United States and Canada (see classified telephone directory) or write direct to: Lindberg Industrial Division, Lindberg Engineering Company, 2321 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg, Ltd., Toronto.

LINDBERG

heat for industry

THERE'S LINDBERG EQUIPMENT FOR EVERY INDUSTRIAL HEATING NEED



1 **Gantry Type Furnaces:** Lindberg Industrial Division has installed a number of Gantry Type Furnaces with auxiliary equipment for heat treatment of missile and rocket components.

2 **Heat Treating Furnaces:** For every requirement, large or small, electric or fuel fired, factory built or field-installed. Shown: Automated Integral Quench Type Carbonitriding Furnace.

3 **Ceramic Kilns:** All types of kilns: automatic, atmosphere controlled, high temperature, tunnel and periodic. Shown: Tunnel Kiln with two automatic control zones for temperatures up to 3200° F.

4 **High Frequency Units:** Complete range of induction heating units and furniture. Shown: New Floating Zone Scanner for production of hyperpure materials for semi-conductors.

5 **Melting and Holding Furnaces:** Equipment for any non-ferrous metal requirement including electric resistance and two chamber induction types, reverberatories, dry hearths and crucibles. Shown: Field-installed Reverberatory Furnace, 80,000 lb. capacity.

6 **Atmosphere Generators:** Generators for all required furnace atmospheres. Shown: Hyen Generator for endothermic atmospheres.

7 **Pilot Plant Equipment:** Complete group of intermediate sized furnaces for pilot plant and small production application. Shown: New Graphite Tube Furnace, temperature range 2500° F. to 5000° F.

8 **Laboratory Furnaces:** Complete line of laboratory furnaces from simple hot plates to specialized research units. Shown: Versatile, wide temperature range Laboratory Box Furnace.

Circle 180 on Inquiry Card for more data

No matter how special your needs

IT PAYS TO PUT YOUR BRAKING

More vehicle manufacturers turn to Bendix® than to anyone else for the answers to their braking needs. The reason: *they find Bendix comes up with the right answer in minimum time and at lower cost.*

We have over 400 *different* types of brakes currently in production. So the answer to a particular braking problem may already exist in our line. If not, our experience and know-how of more than forty years enable us to work out specialized braking problems with the least amount of waste motion. In building over 141,000,000 braking units, we have solved problems for such diverse applications as passenger cars, trucks, buses, tractors, aircraft, golf cars, trailers, motorcycles, mine cars, rail cars, fork lifts, farm machinery, construction equipment, and industrial machinery, plus many specialized requirements.

Since it was formed in 1923, our Brake Engineering Department has established a unique record of development in its field. Four-wheel brakes, the duo-servo principle of braking, and automatic brake adjusters are just a few of the better-known brake advancements developed over the years. Most of the other automotive brakes built today are patterned after Bendix-type brakes.

Power braking is another Bendix pioneering development made practical after years of engineering research and experimentation on every type of automotive vehicle. In fact, one of our

PROBLEMS UP TO BENDIX!

best recommendations is that we do more brake pre-testing work than anyone else in the world. This means that the Bendix user gets a proved product.

First, it's proved in the laboratory with the help of the most scientific equipment to be found. Second, it's proved out in the field. Bendix has a huge test fleet, including a complete line of instrumented vehicles, and special mobile laboratories for conducting actual on-the-road brake tests. And tests are made under the most exacting terrain and climatic conditions.

Whether you need complex, highly specialized braking systems, or mass-volume production units, you can count on Bendix at South Bend to meet your needs exactly. It will pay you to put your braking problems up to Bendix—the largest single manufacturer of brakes in the world.

Our Customer Application Engineers are ready to work with you at any time. Call on them for information and advice.

BRAKE HEADQUARTERS OF THE WORLD

Bendix PRODUCTS DIVISION South Bend, IND

Bendix AVIATION CORPORATION

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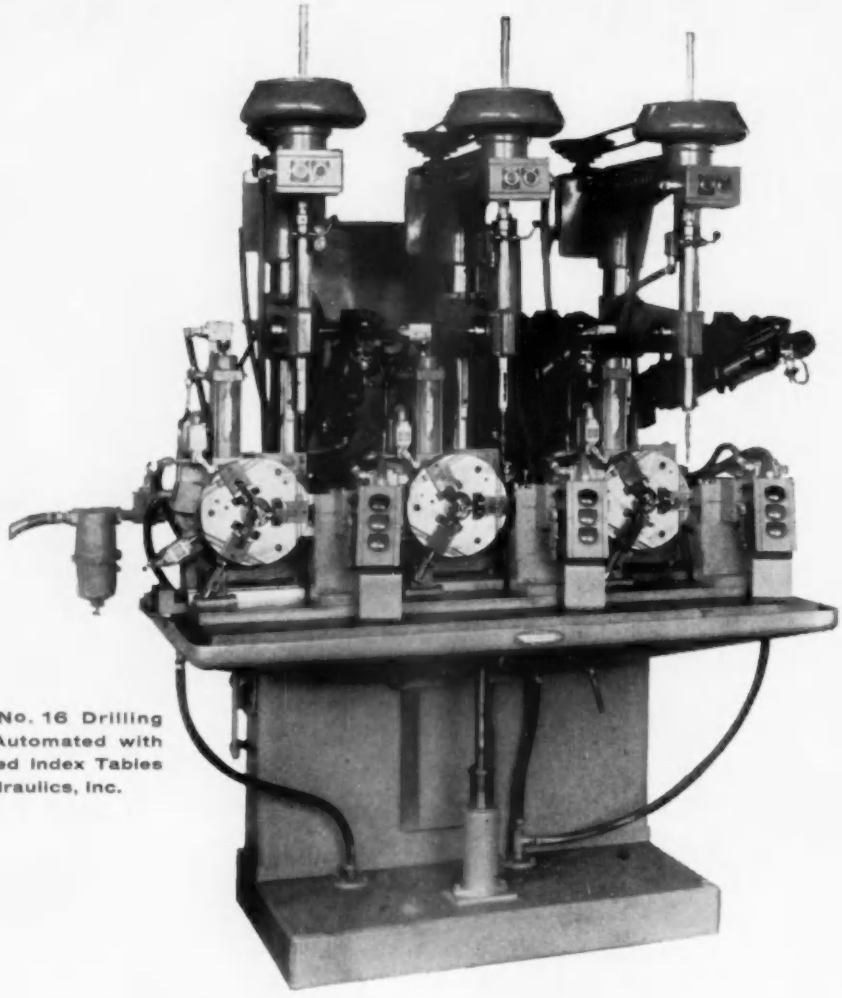

"Buffalo" No. 16 Drilling Machine Automated with Air-Operated Index Tables by Air Hydraulics, Inc.

8 YEARS OF SATISFACTION MADE THIS SALE!

Nothing sells a product like customer satisfaction. Here's proof:

Eight years ago a large mid-western manufacturer bought a "Buffalo" No. 16 Drilling Machine. It proved to be an excellent production machine. Quantity and quality of output were high. The No. 16 stood up to the punishment of continuous production with a minimum of maintenance.

This year the manufacturer decided to automate certain drilling and reaming operations. Because of eight years of complete satisfaction, a new 3 spindle "Buffalo" No. 16 Drilling Machine was specified.

The mechanism for automating the "Buffalo" Drill was designed and built by Air-Hydraulics, Inc. of Jackson, Michigan. Air-Hydraulics used its Model "H", 10" dia. Air-Operated Index Tables. The automated operation was drilling and reaming three lug-holes on the work piece.

The production rate was originally estimated at 150 pieces per hour. Air-Hydraulics reports that the actual production rate is 215 pieces per hour.

Here's a case of "three-way" satisfaction, with "Buffalo" Drills. Both the manufacturer and Air-Hydraulics are satisfied. And we are happy that our customer's satisfaction dictated the choice of a new "Buffalo" No. 16 Drilling Machine for this automation job.

For this kind of complete satisfaction, why don't *you* specify "Buffalo" Drills? Contact your "Buffalo" machine tool dealer, or write us direct for full information.

BUFFALO FORGE COMPANY

503 Broadway Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

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TEMPERATURE CONTROL

. . . an Important Factor in Spring Performance

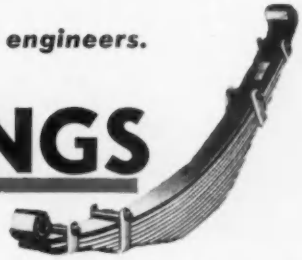
Heating the special alloy bars from which Burton Springs are made is an important operation that must be done right to insure correct spring performance.

This control panel, one of several at the Burton plant, governs and records furnace temperature by automatic pyrometers located inside the furnaces.

Spring quality is affected by the way in which these furnaces are operated and how their operation is supervised. Here, as in every step of manufacturing, Burton Springs receive the utmost care.

America's leading manufacturer of motor transport and off-highway equipment have their springs made in the Burton factory, because they know the care that goes into making Burton Springs assures the utmost dependability.

Bring your next spring problem to Burton engineers.



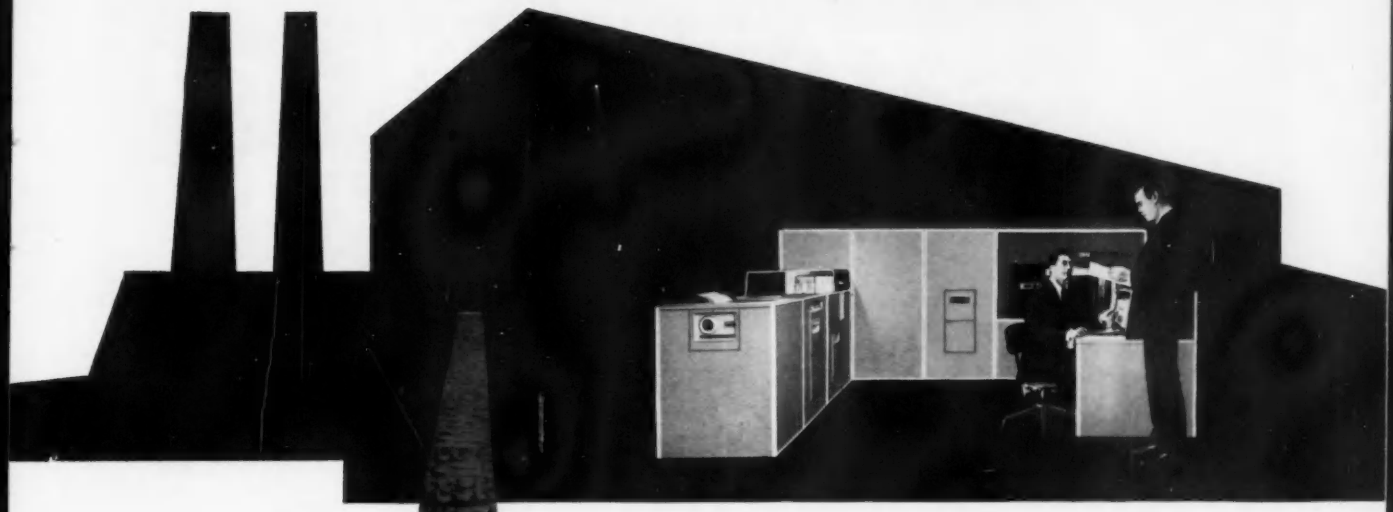
BURTON SPRINGS

VITAL SUPPORT FOR THE AUTOMOTIVE INDUSTRY

BURTON AUTO SPRING CORPORATION, WESTERN AVENUE AT FORTY-EIGHTH STREET, CHICAGO 32, ILLINOIS

AX	15 28	17 30	20 35	25 42	30 47	35 53	40 60	50 70
D_i	15 .5906	17 .6693	20 .7874	25 .9843	30 1.1811	35 1.3780	40 1.5748	50 1.9685
D_e	28 1.1024	30 1.1811	35 1.3780	42 1.6535	47 1.8504	53 2.0866	60 2.3622	70 2.7559

one late decision on inventory and this $50 part* could cost you $5,000



IBM RAMAC® 305

controls inventory data to prevent costly "out-of-stock" conditions

A delay in production caused by an "out-of-stock" part can make that part the most expensive item in your stock. IBM RAMAC 305 gives you the fast and accurate control over inventory that helps you avoid costly shortages—or equally costly overstocking.

As each transaction is entered into RAMAC, all affected records are immediately posted and updated. Management may inquire as to the status of any specified item in inventory. This random access ability is an exclusive feature of the IBM RAMAC.

Balanced Data Processing . . . IBM services as well as machines . . . is a continuing responsibility of IBM to its customers. Like all IBM data processing equipment, RAMAC 305 may be purchased or leased.

IBM®

balanced data processing

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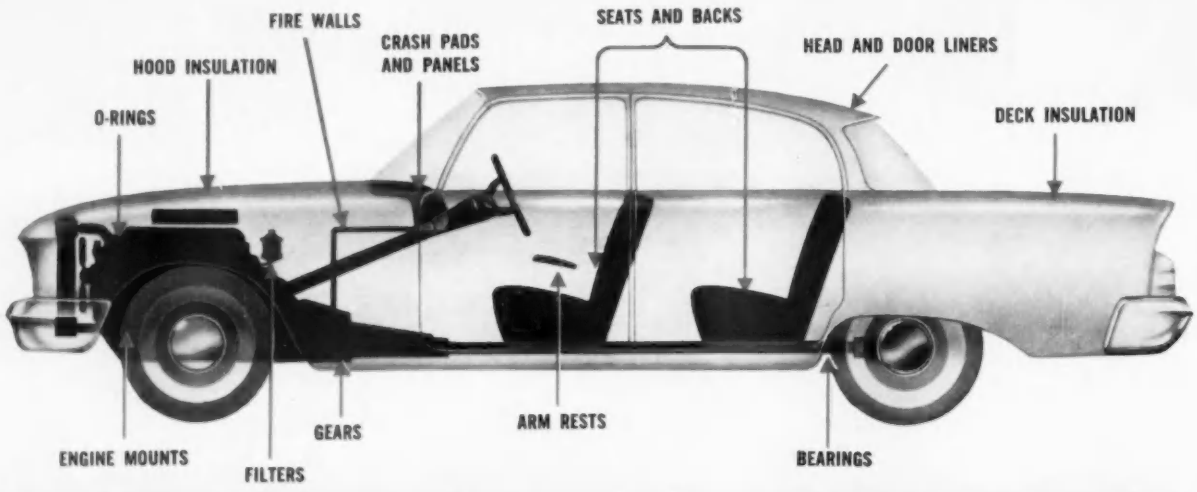
STAFOAM* and DAYCOLLAN*



offer unique solutions to automotive problems

The unique combination of properties of Stafoam and Daycollan, improved urethanes, help solve many problems in automotive design. Seating, liners, insulation, mounts, fire wall, filters, gears, bearings and O-rings are but a few of their applications. In each case components made of these miracle materials make possible more efficient design and operation, increased reliability and reduced costs.

Stafoam, pre-formed or foamed-in-place in flexible or rigid types, has excellent thermal and acoustical qualities. Fire, oil and fungus resistant, it has good tensile, compression and shear strength. Easily fabricated, it can be cut, sliced, heat sealed, sewn, die cut or molded into the most intricate shapes.

Daycollan urethane elastomers are custom made to specification for molded mechanical components. They have the common properties of high energy absorption, exceptional shore hardness, tear strength and abrasion resistance.

It will pay you to investigate the multiple advantages implicit in the simplified design, longer life and greater reliability of components made of Stafoam and Daycollan. For complete information call or write The Dayton Rubber Co., Urethane Div., Dayton 1, Ohio.

**Registered Trade Mark*

Daycollan®

made by THE DAYTON RUBBER COMPANY, Dayton, Ohio and its West Coast Division, AMERICAN LATEX PRODUCTS CORPORATION, Hawthorne, California

HEADQUARTERS FOR **NEW** IDEAS

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YOURS FOR THE ASKING . . .

the ALL-NEW AUTOMOTIVE INDUSTRIES

EDITORIAL INDEX (Vol. 121)

covering the issues from July 1 to December 15, 1959, inclusive

Your copy of the newly revised Editorial Index is now available. This handy index saves valuable time in searching for specific subjects covered in the past issues of AUTOMOTIVE INDUSTRIES, and is made available to you as an additional service.

Easier to Use

The new Index quickly summarizes all the editorial articles alphabetically by subject along with page numbers and date of issues in which they appear. Articles are listed under several major classifications with considerable cross-indexing for quick reference.

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AUTOMOTIVE INDUSTRIES

Chestnut & 56th Sts.
Philadelphia 39, Pa.

Please send me, without charge, the new AUTOMOTIVE INDUSTRIES Editorial Index covering the 12 issues from July 1 to December 15, 1959, inclusive (Volume 121.)

Name .....

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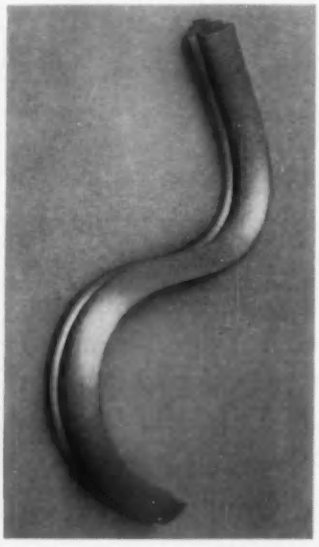
COMPLEX CROSS SECTIONS

WEATHER AND OZONE RESISTANCE

LOW WATER ABSORPTION



TIGHT RADII EASILY TURNED

EXTRUDED CLOSED CELL

NEOPRENE IMPROVES BODY SEALING

Only neoprene closed cell extrusions offer all these proven advantages as a body seal:

Excellent resistance to weather, ozone, aging, sun and oil.

Low water absorption; due to the characteristic closed cell structure, water absorption is held to a minimum . . . eliminates need for a veneer or coating.

Available in a variety of complex cross sections . . . adaptable to any closure design.

Tight radii easily turned without wrinkling.

Extruded closed cell neoprene is already being used effectively as a door and deck lid seal and as a hood lacing. Potential applications include roof rail seals, windlace and other body gasketing applications.

For more information on this new approach to body seal design, write for your free copy of our helpful brochure, EXTRUDED CLOSED CELL NEOPRENE.

E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department AI-2, Wilmington 98, Delaware.

DU PONT
REG. U. S. PAT. OFF.

SYNTHETIC RUBBER
NEOPRENE HYPALON® VITON® ADIPRENE®

Better Things for Better Living . . . *through Chemistry*

wheels that speak with international good taste

Working closely with the automotive industry for over fifty years, Kelsey-Hayes has pioneered many major advances in wheel and brake design. Among the most recent is the new integral cast-aluminum hub and drum, wherein the braking surface is provided by a special iron liner metallurgically bonded in place. Exposed to the air-stream, through a specially designed steel wheel, its ribbed aluminum structure affords maximum cooling for uniform, fade-free brake performance and greatly extended life. Kelsey-Hayes Company, Detroit 32, Michigan.

KELSEY HAYES COMPANY

Automotive, Aviation and Agricultural Parts
Hand Tools for Industry and Home

18 PLANTS: Detroit and Jackson, Michigan; Los Angeles; Philadelphia and McKeesport, Pennsylvania; Springfield, Ohio; New Hartford and Utica, New York; Davenport, Iowa; Windsor, Ontario, Canada.

K H

Circle 189 on Inquiry Card for more data

(Advertisement)

DOW | MAGNESIUM

MAGNESIUM DELIVERS 4 TIMES MORE DIE CASTINGS *per pound than zinc!*

4 pounds of magnesium make . . .

4 pounds of zinc make . . .

Magnesium die castings have a long history of successful application in automobiles—and for several good reasons. You get more *volume* of lightweight magnesium per pound, thus you get more die castings per pound. Aluminum, for example, is 50% heavier—zinc and steel four times heavier—than magnesium. You save on production costs because magnesium can usually be die cast 50% faster than aluminum. It can be machined faster, too.

If weight or time saving is *your* problem, check magnesium with your die casting supplier or write to: Automotive Development Engineering, Magnesium Sales Dept. 1100T2-15, THE DOW CHEMICAL COMPANY, Fisher Building, Detroit, Michigan.

A FEW EXAMPLES of the many automotive parts die cast of magnesium.

Instrument panels and bezel rings
Fan spacers
Steering column parts

Engine Parts, including:
Generator end plates
Starter end plates

Fuel pump cover
Main bearing oil seals
Drive parts

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

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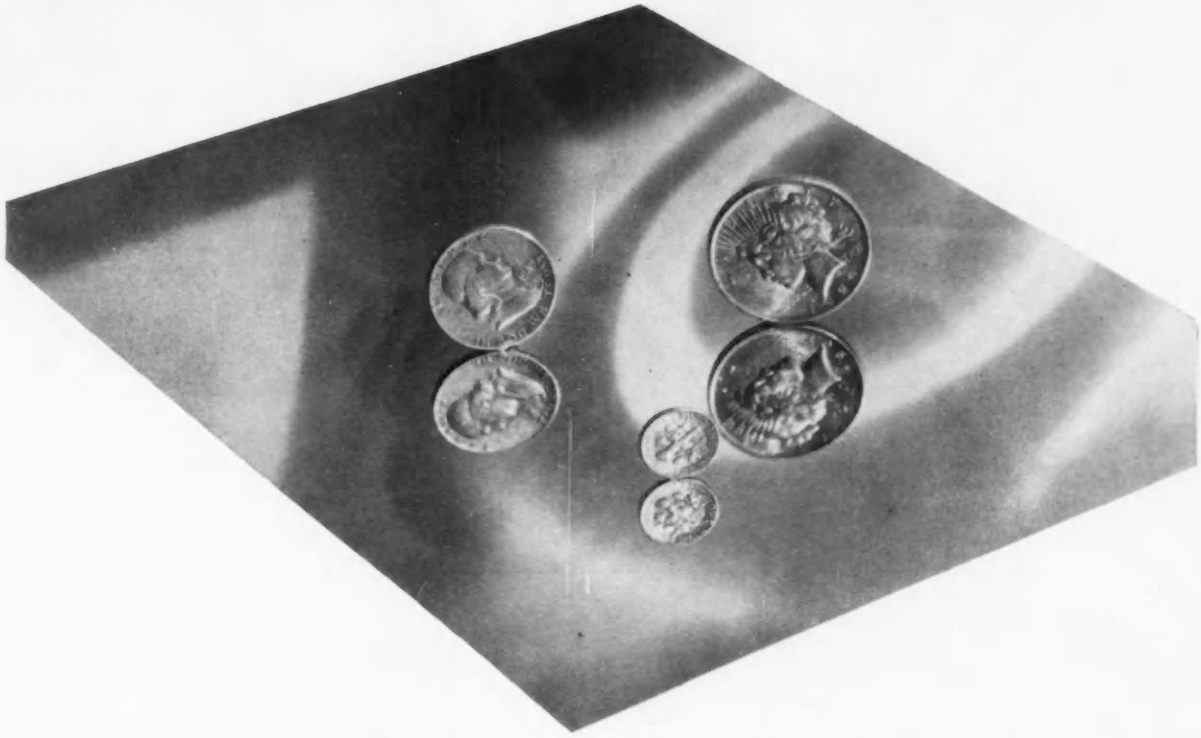
HOW MANY COINS?



Three, but they are easily mistaken for six when set on edge and mirrored in the bright Molding Quality Finish on Armco 17 Stainless Strip.

This high-luster finish is economical for automotive trim because it is a *mill finish.* Armco 17 (Type 430) Stainless Steel is first rolled to precise thickness on a Sendzimir mill, then bright-annealed to retain as-rolled luster. In final tempering, special rolls impart the unique mirror-like qualities of Armco's Molding Quality Finish.

Luster retained in forming

With normal precautions, Armco Molding Quality Finish holds its bright luster through forming operations. This minimizes costly buffing. In addition, economical Armco 17 Stainless is easy to color-match with other trim materials.

Price and delivery information are readily available from your nearest Armco Sales Office. If you'd like more information on economical Armco Stainless Steel, just fill in and mail the coupon.

New steels are born at Armco

ARMCO STEEL CORPORATION
1120 Curtis Street, Middletown, Ohio

Please send more information on Armco 17 Stainless.

Name_____ Title_____

Firm_____

Street_____

City_____ Zone___ State_____

ARMCO STEEL

Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation

H. C. DAUM
Manager, Machining Process Department
Manufacturing Engineering Office, Ford Motor Company
Chairman

J. Q. HOLMES
Director, Production Engineering Section
General Motors Corporation
Member

Congratulations

It has been our privilege to cooperate closely with the members of the Special Machine Tool Standards Committee, their staffs and other users.

Basic standardization is opening new fields for expanded use of multiple operation machine tools in the metalworking industry.

All of our proposals are now based on the new standards. Our first large SMTS machine is under construction. Others are in the design stage.

To the Special Machine Tool Standards Committee which conceived the ideas and labored so long and so well for the establishment of these standards, Buhr says, "Congratulations on a job well done."

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICHIGAN

K. C. BUTTERFIELD
Staff Master Mechanic, Chrysler Corporation
Member

R. L. WITSCHE
General Supervisor, Mechanical Engineering Research
International Harvester Company
Member

TO THE SPECIAL MACHINE TOOL STANDARDS COMMITTEE

on initiating and coordinating the move toward standardization of basic "building blocks" for special machine tools

BUHR

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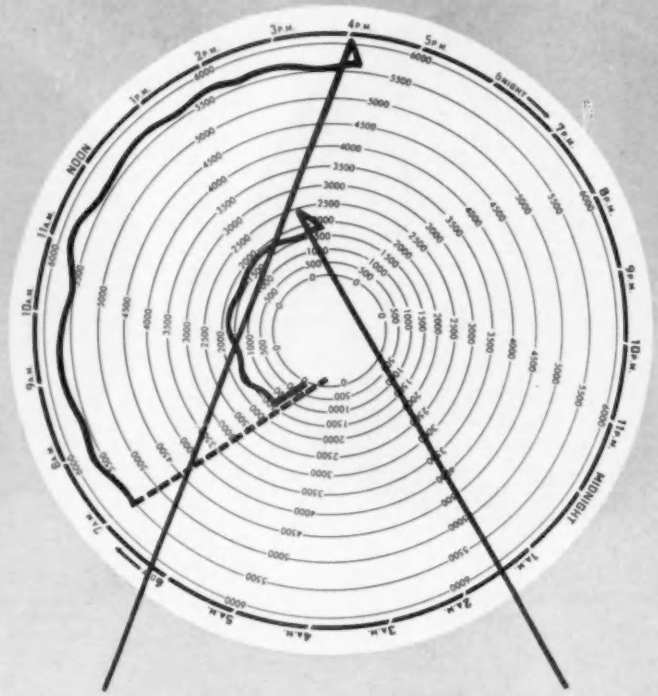
STEAM RECORDERS SHOW

$25,000 a year savings



. . . WITH COLD BONDERITE SYSTEM

A manufacturer of household appliances decided to find out for himself! Steam recorders were hooked to two identical 5-stage phosphating lines—one using conventional hot solutions and the other line using the Cold Bonderite System.

Steam consumption on the "hot" line measured 5742 pounds per hour; the Cold Bonderite line used only 1561 pounds per hour. A difference of 4181 pounds, or *72.8%!*

Converted to dollars, the manufacturer estimates that Cold Bonderite, on all his production, will save $25,878 per year.

He is changing his other phosphating lines to the Cold Bonderite System as quickly as he can!

Cold Bonderite Systems operate at temperatures from 40 to 75° below conventional phosphate systems for surface treatment of metals. Coatings are of highest quality. Savings are *automatic*. Balanced formulation permits the use of accelerated solutions, easy to operate and control. You can choose between zinc or iron phosphates. Spray or immersion application to fit your production requirements.

The changeover to a Cold Bonderite System is simple and quick. Act now. You can have it installed and working to save you money by this time next week.

Call in your Parker representative today!

Since 1914— leader in the field

Parker Rust Proof Company

2178 E. MILWAUKEE, DETROIT 11, MICHIGAN

BONDERITE corrosion resistant paint base	BONDERITE and BONDERLUBE aids in cold forming of metals	PARCO COMPOUND rust resistant	PARCO LUBRITE—wear resistant for friction surfaces	TROPICAL—heavy duty maintenance paints since 1883

**Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.*

The 42nd Annual

AUTOMOTIVE INDUSTRIES STATISTICAL ISSUE

published March 15th

answers countless questions on all these automotive subjects:

MOTOR VEHICLES

Statistics on
- Production
- Factory Sales
- New Registrations
- Total Registrations
- Exports and Imports of Cars, Trucks, Buses, Trailers

Aviation
- Shipments of airframes and their value
- Registrations
- Air Carrier Operation Statistics
- Airports and Landing Fields

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- Cars
- Trucks
- Buses
- Military Cargo Vehicles

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- Industrial Trucks

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Statistics Pertaining to
- Corporate Profits
- Installment Credit
- Wages by Industries
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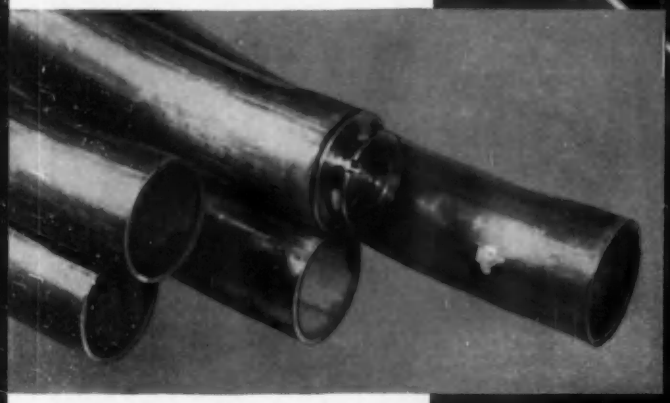
☐ Cash enclosed ☐ Check Enclosed ☐ Money Order Enclosed

Mail this to: Automotive Industries, 56th & Chestnut Sts., Phila. 39, Pa.

Non-Magnetic and salt-corrosion-resistant Republic ELECTRUNITE® Stainless Steel Tubing, Type 304, 4½" O.D., was used to fabricate corona rings for a powerful East Coast Navy Radio Station. Despite the rather severe bend of the 15- and 20-foot rings, the fabricator reported no trouble whatsoever. The rings were made in three sections. ELECTRUNITE was bent to the correct radius. Three lugs were welded to each section. The ends were flared for the insertion of a plug used at the erection site to assemble the three pieces into a complete ring and suspend it from towers approximately 1,400 feet high. The fabrication was handled by Jentsch & Company, Inc., Buffalo, New York, subcontractors to Lapp Insulator Company, Leroy, New York.



Bend, Flange, Weld, Easy-to-Fabricate ELECTRUNITE STAINLESS STEEL TUBING

ELECTRUNITE Stainless Steel Tubing and Pipe are available in A.I.S.I. chrome-nickel analyses. Sizes range from ⅜" O.D. to 5" O.D. Pipe sizes are available from ⅛" I.P.S. through 2" I.P.S. in ASA schedule 40S; from ⅛" I.P.S. through 4" I.P.S in schedule 10S; and from ½" I.P.S. through 4" I.P.S. in schedule 5S wall thicknesses.

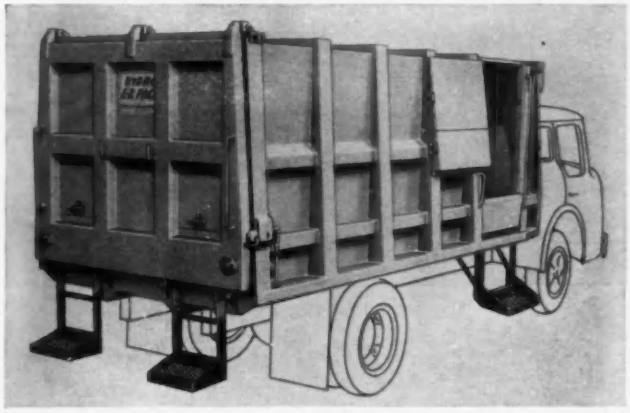
This fabricator needed a reliable source to supply large diameter heavy wall stainless steel tube for corona rings. From its large size range, Republic was able to provide the proper tube for this vital application.

Most experienced welded tube maker, and world leader in the production of stainless and alloy steels, Republic has all the facilities to qualify as your number one source. Complete range of sizes, gages, wall thicknesses. Broad distributor stocks. Large inventories of mill stocks to draw on. Top reputation for quality and for ability to meet deliveries. Technical and metallurgical assistance. Fast service: price and delivery quotations to you within twenty-four hours.

For applications requiring pressure-tested tube, Republic offers exclusive FARROWTEST —the ultimate in non-destructive testing. This eddy-current test probes for and detects defects so minute they pass other, less positive tests. Tube quality is measured for you!

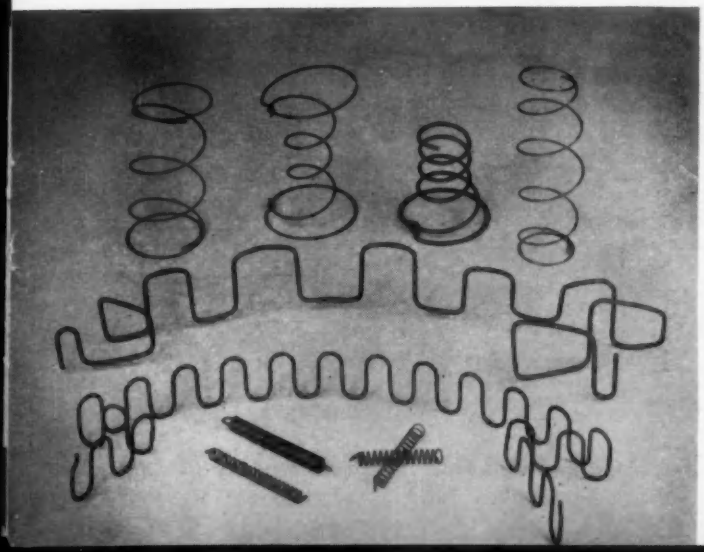
Send in your inquiries for Republic ELECTRUNITE Stainless Steel Tubing and Pipe. You'll like the product . . . and the service.

REPUBLIC NYLOK® STUDS SOLVE FASTENING PROBLEM for Gravely Tractors, Inc., Dunbar, West Virginia. Problem: Find a dependable fastening method for tractor-attached rotary cultivators. Fasteners must withstand constant shocks and pounding of rotary cultivating. Solution: Use Republic NYLOK Studs. A special nylon insert assures positive locking at any position, even under severe shock, vibration, tension. Prevents all play. Utilizes metal-to-metal contact of opposing threads for locking. Republic NYLOK Fasteners —studs, nuts, cap screws—are re-usable. Nylon insert resists heat, cold, moisture. Mail coupon for facts.



REPUBLIC HIGH STRENGTH STEEL SOLVES WEIGHT PROBLEMS in Hydro E-Z Pack enclosed truck bodies, manufactured by Hercules Galion Products, Inc., Galion, Ohio, for haulers of refuse and garbage. Use of Republic "50" High Strength Steel reduces body weight, permits increased payload on smaller chassis, and the hauler makes fewer trips to the dump. Republic "50" stands up under heavy force of packer blade, resists corrosive action of refuse, and abrasive effects of cans, crates, and other materials. To find out how Republic High Strength Steel can pay off in your application, send coupon.

REPUBLIC STEEL WIRE of consistently uniform quality that assures accurate, easy forming with adequate strength and toughness to meet the most difficult design and forming problems. Strong, ductile, tough, Republic Steel Wire is available in many types and in a wide range of gages and physicals for almost any product you can imagine. The variety of products illustrated above are examples of "imagenuity in wire"—engineering imagination plus modern business ingenuity. Write for more information.



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World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. AI-8737
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on the following products:

☐ Republic ELECTRUNITE Stainless Steel Tubing
☐ Republic High Strength Steels ☐ NYLOK Fasteners
☐ Republic Wire

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

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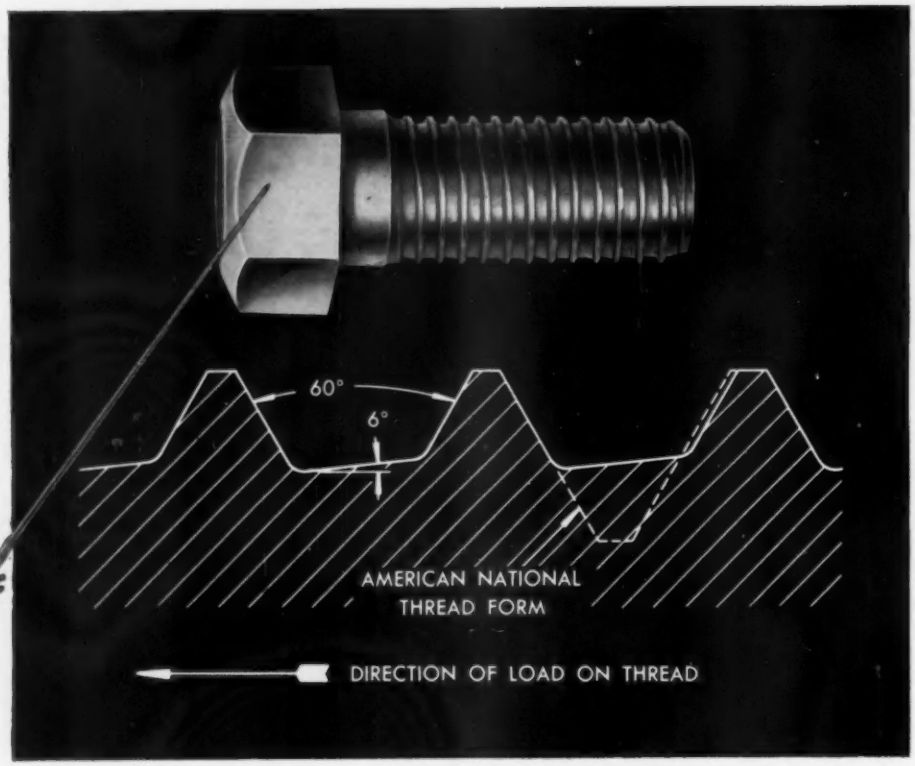
NAT'S quick facts about Fasteners...



Can **any** fastener actually **become tighter** in service?

WELL, HARDLY. NOT JUST *ANY* FASTENER...

But self-locking, extra-strength LOK-THRED® bolts, studs and screws *do*, and even after long service you can expect their breakaway removal torque to average about 70% higher than at installation.

Here's the reason. Just take a look at the LOK-THRED profile. Notice the extra-wide root? And its converging angle? It's held, strictly by design, to exactly 6 degrees.

Now, see what happens, as you drive any LOK-THRED fastener. It re-forms the metal of the receiving thread, squeezing out every void, and forming an intimate metal-to-metal contact. And each of the angled roots becomes a 6-degree tapered wedge, with the loading constantly pulling against it to make its anchorage even firmer.

That's why LOK-THRED fasteners actually *do* become tighter in service. They're self-sealing, too . . . fluids can't leak past them. And yet they're fully reusable . . . require no selective fits . . . can be used with ordinary tools.

Take our word for it, there are plenty of reasons* why LOK-THRED is superior for many kinds of fastening . . . and we'll be glad to help you develop any applications to your own products.

*They're all given in National's LOK-THRED booklet, with plenty of supporting data. Write for your copy.

National PRODUCTS

The National Screw & Mfg. Company • Cleveland 4, Ohio

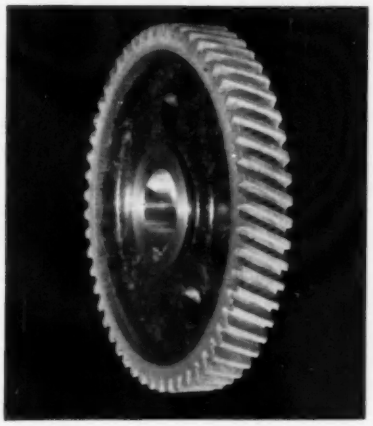
California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

Circle 187 on Inquiry Card for more data

PROGRESS IN PLASTICS

CDF CELORON GEARS ARE QUIET, WEAR LONGER

Why plastics for gears? Because laminated-rim molded Celoron® gears are *quiet* (eliminate the annoying noise of chain timing and metal-to-metal gearing). Because they reduce heat and wear on mating metal gears, thereby reducing repair costs and preserving accuracy throughout the life of the engine.



Strength. Stamina is built into every CDF Celoron gear. Stronger teeth, longer running life, and smoother performance are characteristics of the Celoron gear. No type of "cheaper" gear construction has yet proved as satisfactory.

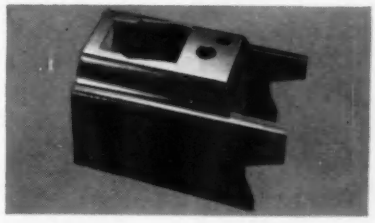
What it is. Each CDF Celoron gear blank is molded of laminated and macerated cotton cloth impregnated with a special phenolic resin. Gear teeth are cut in the laminated rim. Repeated tests prove the high impact strength, the great wear-resistance, and the low tone frequency of this "silent" gear material.

Design and purchasing men interested in adapting Celoron gears for engine-timing and other needs may obtain full technical data (properties, horsepower ratings, etc.) by writing to the Celoron Division of CDF at Bridgeport, Pennsylvania.

COMPLICATED PLASTICS PARTS AT LOW COST THROUGH POSTFORMING CDF DILECTO

How it's done. Briefly, postforming is effected by heating a special grade of CDF Dilecto® laminated plastics until it's pliable, and then forming it in an unheated, inexpensive mold.

Less expensive. When you postform Dilecto parts, you generally save money all around: Lower die costs (often wood or plastics is entirely satisfactory); lower retooling costs to meet new specifications; lower labor costs—these are a few of the savings made possible through postforming of Dilecto.



Why Dilecto? Where you need high strength-to-weight ratio, superior electrical and chemical properties, light weight, easy machinability, and excellent resistance to abrasion, weathering, and moisture—CDF Dilecto laminated plastics give you the best combination. CDF delivers either the Dilecto stock or the completely fabricated parts as specified.

Special Dilecto grades. For better response to severe bends and deep draws, and for the ability to take the most involved forming without fracturing, choose one of the special postforming grades of Dilecto, described in CDF Technical Bulletins 11,110 and 11,140. Most of the standard Dilecto grades, though, can be postformed to some degree.

SMALL ELECTRICAL PARTS BY THE MILLIONS

CDF specializes in the complete fabrication of plastics and fibre components for automotive and aircraft use. These breaker-arm bushings were made from

Dilecto tubing on automatic screw machines, by men who know best how to cut costs in working laminated plastics. Investigate CDF's extensive fabricating facilities—let CDF do the whole job, and assure your own production deadlines.

NEW CDF LITERATURE • *For Bulletins referred to in this advertisement, or for recommendations relating to your current problem in electrical insulation, send this coupon.*

Please send the following Technical Bulletin(s):

☐ Celoron Molded Gears, Bulletin C-58

☐ Dilecto Postforming Grades, Bulletins 11,110 and 11,140

☐ Please have a CDF representative call to discuss my electrical-insulation problems in detail.

Name_____ Title_____

Company_____

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City_____ Zone_____ State_____

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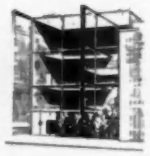
A SUBSIDIARY OF THE Budd COMPANY • NEWARK 2, DEL.

In Canada: Continental-Diamond Fibre of Canada Ltd., 46 Hollinger Road, Toronto 16, Ont.

AUTOMOTIVE INDUSTRIES

A CHILTON  PUBLICATION

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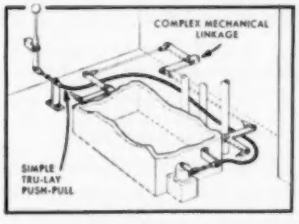
TRU-LAY PUSH-PULL DATA FILE SHOWS HOW TO SIMPLIFY AND IMPROVE DESIGN



Push-Pull remote controls, shown here, are flexible, have but one moving part, and give a lifetime of accuracy. Mechanical linkages are complex, are made of many parts, wear at many points, and produce increased backlash, lost accuracy, and vibration rattles.

This Push-Pull Data File—containing 7 engineering bulletins—will show you how these flexible controls have eliminated mechanical linkages on hundreds of products. You can make *your* products more useful, easier to sell, with Push-Pull controls. Write for your Data File today.

Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

ACCO

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6800-H East Acco Street, Los Angeles 22
929-H Connecticut Ave., Bridgeport 2, Conn.

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of
GREY IRON CASTINGS

ONE OF THE NATION'S LARGEST AND MOST MODERN PRODUCTION FOUNDRIES

ESTABLISHED 1866
THE WHELAND COMPANY
FOUNDRY DIVISION

MAIN OFFICE AND MANUFACTURING PLANTS
CHATTANOOGA 2, TENNESSEE

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WATEROUS' FULL-TORQUE, SPLIT-SHAFT PTO

This new WATEROUS PTO is offered for driving a wide variety of hydraulic and other accessory equipment—from augers to portable mills. Get *full* power; forget separate engines with their extra cost, space and weight. The WATEROUS *Electro-Matic* control is operated from the cab or other desired location; assures quick, positive engagement. Multiple output shafts plus a wide variety of ratios, from one-half to twice engine speed, make the WATEROUS PTO truly "custom engineered" to your needs.

EASY TO INSTALL. Three-point suspension between frame rails leaves drive-line angle intact.

Built by pioneers in the automotive field. Heavy duty split-shaft PTO's. Truck transporter pumps. Fire and marine pumps. For information, write:

WATEROUS COMPANY

80 East Fillmore Avenue, St. Paul 7, Minnesota, Dept. 60Pl

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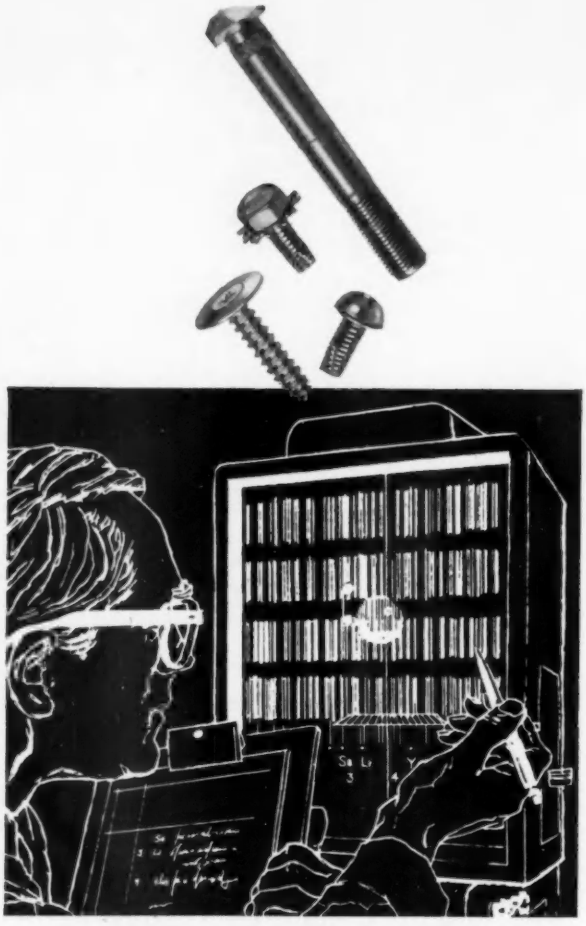

The high quality of **NATIONAL LOCK FASTENERS** is more than skin deep

Quality wire is the basic ingredient for quality fasteners. That's why, at National Lock, quality control starts with elements of the raw wire. Here, a unique *spectograph* is used to make a complete qualitative analysis of the metal that goes into National Lock fasteners and cold-headed products. And, too, size, thread dimension, finish and other exacting customer specifications are checked with equal vigilance and thoroughness. National Lock fasteners are quality made inside and out to assure long-term, dependable performance.

STANDARD AND SPECIAL-PURPOSE FASTENERS
FOR AMERICAN INDUSTRY SINCE 1909

NATIONAL LOCK COMPANY

FASTENER DIVISION, ROCKFORD, ILLINOIS

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for your own
ENGINEERING LIBRARY

New Catalogues, Bulletins, Data Sheets and Reports

Advertisers' Products and Services Data; and more Information on New Production Equipment and New Products described editorially in this issue

FREE POSTCARD INQUIRY SERVICE

Just circle the Numbers you want on Inquiry Postcards, and mail promptly

Hose Assemblies 1

A 31 page catalog, containing many illustrations and charts, describes the right and wrong way to install high pressure hose assemblies and couplings. Pressure capacity and specifications plus selection and design data are also included. *Eastman.*

Hydraulic Shears 2

An eight page catalog covers a line of hydraulic shears that have a capacity range of 8 ft of ⅜ in. to 12 ft of 1½ in. mild steel. Contained is a chart that lists 28 specifications for 39 different shears. Safety, design and fabrication data are also given. *Verson Allsteel Press Co.*

Switch Assemblies 3

Design, engineering and application information are covered in an illustrated catalog that covers a complete line of toggle switches and switch assemblies. There are many charts and drawings showing operating characteristics and electrical components. *Micro Switch Div., Minneapolis-Honeywell Regulator Co.*

Tube Furnaces 4

A modern and expanded line of electric furnaces, with temperature ranges up to 5000 deg F, is described in a recently released bulletin. A chart shows specifications, capacity and application data. *Harper Electric Furnace Corp.*

Tool Tips 5

A seven page, illustrated booklet describes many machine tools and gives information on minimized producton costs. *Ex-Cell-O Corp.*

Coated Wire 6

A technical bulletin on the permaluster process contains a chart, engineering data and operation information. *Permaluster Inc.*

Position Encoders 7

Four page bulletin number 316-A gives a general description of a line of geared shaft position encoders. Principles of operation, illustrations, technical information and other bulletin numbers are shown. *Datex Corp.*

FREE LITERATURE---USE THESE POSTCARDS

(Please turn page)

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Advertisers' Products and Services Data; and more information on New Production Equipment and New Products described editorially in this issue.

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Circuit Breakers 8

The new comprehensive 60 page Speedfax catalog contains numerous charts and design information designed to aid in application selection of the circuit breaker. This three section, illustrated catalog gives specification and engineering data and a new price list. *I-T-E Circuit Breaker Co.*

Magnetic Plugs 9

There are 32 magnetic plugs listed in a chart with 7 specifications shown to aid in design and selection of the proper plug and use of that plug. *Lisle Corp.*

Power Units 10

Engine and power unit ratings are covered in a six page, illustrated data chart that is laid out for "quick reference." *Waukesha Motor Co.*

Controls 11

Bulletin 110 entitled "A Guide to Industrial Electrohydraulic Servo Components and Systems" has been published in a 20 page booklet. It is designed to provide engineers with a current summary of the basic principles and potential applications of electrohydraulic servocontrol mechanisms. *Moog Servocontrols, Inc.*

Self-Locking Nuts 12

Two bulletins are available on an aluminum nut line that features stainless steel threads in an aluminum case body. They contain charts, illustrations and engineering information. *Waltham Precision Instrument Co.*

Diesel Engines 13

A new brochure describes and illustrates diesel engines. Specifications, technical and engineering data are covered. Charts and graphs show fuel economies and operating characteristics. *International Harvester Co.*

Industrial Laminates 14

A new comprehensive, 16 page catalog lists applications, special features, detail characteristics and sizes available in 50 grades. Complete charts show a wide range of technical information. *General Electric Co.*

Conversion Chart 15

A very useful wall chart lists common conversions such as: inches to centimeters; watts to hp; atmospheres to Kgs/ sq cm; cm/ sec to miles/ hr; cu-ft to liters; microns to meters; quintal to lbs and many other odd and hard to find conversions. *Precision Equipment Co.*

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Furnace Brazing 16

There are 18 different subjects covered in a new 50 page catalog describing components, applications and technical problems in furnace operations. *General Electric Co.*

Housings Catalog 17

Explosion-proof design information, detailed drawings, photographs and a dimension chart all describe a complete line of cast aluminum housings. Many other items in this and related lines are also covered in this 15 page booklet. *Adalet Mfg. Co.*

Hydraulic Motors 18

A comprehensive 72 page catalog gives full design details and operating characteristics on a complete line of hydraulic pumps, fluid motors and valves. This well illustrated material contains many performance charts and engineering data. *Denison Engineering Div., American Brake Shoe Co.*

Fatigue Testing 19

A bulletin describes a versatile line of fatigue testing machines in the 12,000 to 300,000 lb range. It covers load range, stroke and frequency data. *Riehel Testing Machines, Div of American Machine and Metals, Inc.*

Heavy Duty Lathe 20

A new eight page booklet, that is fully illustrated, covers the specifications and capacity of a new lathe. *Nebel Machine Tool Corp.*

Stainless Tubing 21

A new 34 page booklet gives design details, corrosion resistance, grades and various size information on stainless steel tubing. Applications, charts and specifications are covered also. *Allegheny Ludlum Steel Corp.*

Accessory Catalog 22

"Tedeco Aviation Grade Gear Case Accessories" is the name given to a new catalog offered to industry to aid in the selection and application of a complete line of drains, plugs and accessories. *Technical Development Co.*

Hand Torches 23

A complete line of hand torches for gas cutting and welding is covered in a 36 page catalog that includes specification charts and all pertinent information to aid in the proper selection for specific applications. *Air Reduction Sales Co.*

Electric Plants 24

A special folder lists a complete line of gasoline engine-driven electric generating plants. Charts show capacity watts and other important specifications. The capacity covered by these charts is in the 500 to 85,000 watt range. There are also illustrations in this material. *D. W. Onan and Sons Inc.*

Precision Inspection 25

A four page booklet describes a new line of gamma radiography machines that have been primarily designed for under-the-surface inspection by non-destructive testing. These machines are said to be also applicable to other phases of inspection. This booklet shows specifications, applications and engineering design data for 16 machines. *Radiation Engineered Services.*

Stainless for Cars 26

A colorful brochure contains illustrations of an automobile and a truck "of the future." Various components of these ultra modern vehicles are shown in separate dimension drawings and cutaway views. *McLouth Steel Corp.*

Polishing Wheels 27

New literature and catalogs describe an expanded line of inflated and expanding polishing wheels, sanding drums, belt sanders and expanding cones. *Nu-Matic Grinders, Inc.*

Synclinal Filters 28

Complete engineering and design information is shown in numerous charts and illustrations that are included in a catalog that describes a complete line of industrial filters. Specific application data, and use of these filters with hydraulic oils, coolants and lubricants is also covered. *Marvel Engineering Co.*

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Thread Root Data 29

Thread root problems are discussed in an interesting booklet called "The Root of the Thread." There are charts, graphs and illustrations to show the result of tests made on fatigue machines and theory information as to the design and strength of various types of threads. *Standard Pressed Steel Co.*

Salt Bath Furnace 30

Aluminum dip brazing, annealing, solution heat treating and many other operations and processes are covered in a new, illustrated catalog offered by the *Lindberg Engineering Co.*

Design Catalog 31

A twelve page condensus of a one-hundred-forty page catalog has been published specifically for the design engineer. All basic engineering data and specifications on various size and type nuts is included. There are many illustrations, cut-away drawings, charts and graphs shown also. *National Machine Products Co.*

Electric Plants 32

This new eight page booklet describes a line of diesel powered electric plants. Illustrations, model specifications and standard equipment are given. *Kohler Co.*

Multi-Arc Welding 33

Technical and economic significance of recent developments in multi-arc welding are highlighted in an illustrated bulletin. A schematic drawing along with technical and specification information fully shows this operation. *J. B. Nottingham & Co.*

Numerical Control 34

Four sections and twenty pages discuss industrial problems, applications and questions about numerically controlled machines. This material contains many illustrations and discriptions of Numera-Trol, the trade name for machines manufactured. *Ex-Cell-O Corp.*

Industrial Dryer 35

This new four page bulletin illustrates typical installations for industrial applications. Typical oven material handling set-ups are covered also. *J. O. Ross Engineering, a Div. of Midland-Ross Corp.*

Induction Heating 36

A technical fact and specification brochure concerning induction heating equipment contains charts, graphs, illustrations and engineering data. It has an alphabetical index in the front for easy reference to the information contained in its 54 pages. *Induction Heating Corp.*

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Exclusively **DOUBLE BONDED**
"Ni-Resist" IRON TOP RING SECTION
METALLURGICALLY A1-Fin Process
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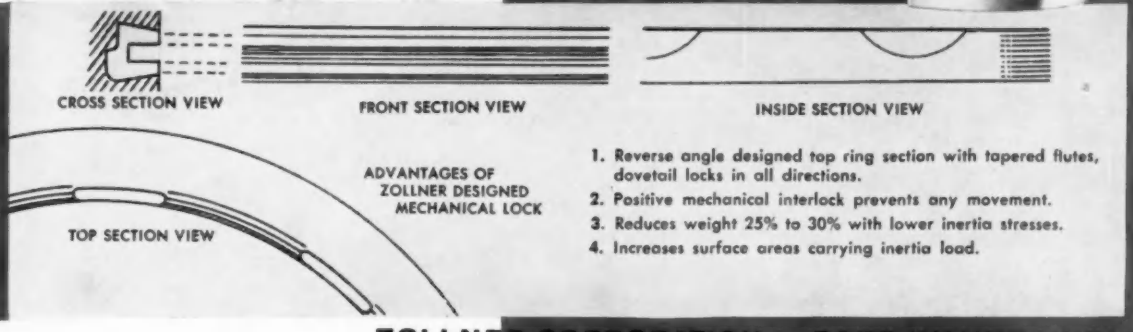
Stops Ring Groove Wear

Everywhere, engine builders and transport operators enthuse over the performance of Zollner Bond-O-Loc Pistons — "The greatest mileage piston we have ever used. Top ring groove wear problems are eliminated by the 'Ni-Resist' Iron section **permanently** incorporated with the double bond of both A1-Fin metallurgic **and the exclusive** Zollner mechanical lock." For longer piston life, better performance and lower maintenance cost, we suggest your immediate test of Bond-O-Loc advantages.



1. Reverse angle designed top ring section with tapered flutes, dovetail locks in all directions.
2. Positive mechanical interlock prevents any movement.
3. Reduces weight 25% to 30% with lower inertia stresses.
4. Increases surface areas carrying inertia load.

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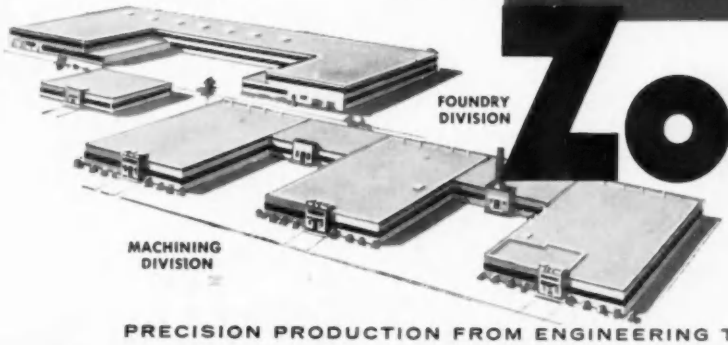

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HEAVY DUTY PISTONS

PRECISION PRODUCTION FROM ENGINEERING TO FOUNDRY TO FINISHED PISTONS

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How N/D Minimizes Electric Motor Noise!

In New Departure's full-time noise analysis program, a unique sound booth and special electronic sound level equipment are used to pinpoint and evaluate electric motor noise. Inside the booth, a condenser microphone picks up air-borne noise from the running motor. Outside, the signal is electronically registered and recorded.

By changing one variable at a time, such as bearing or mounting design, or lubricant, N/D engineers are able to select the proper combination that results in the quietest motor operation. That's why you'll find New Departure precision ball bearings specified for electric motors to be used in quality home appliances, instruments, fans, hand tools and other applications . . . for greater consumer sales appeal.

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